

FM 101-10

PART 1

DEPARTMENT OF THE ARMY FIELD MANUAL

STAFF OFFICERS'
FIELD MANUAL
ORGANIZATION,
TECHNICAL AND
LOGISTICAL DATA
PART 1
UNCLASSIFIED DATA

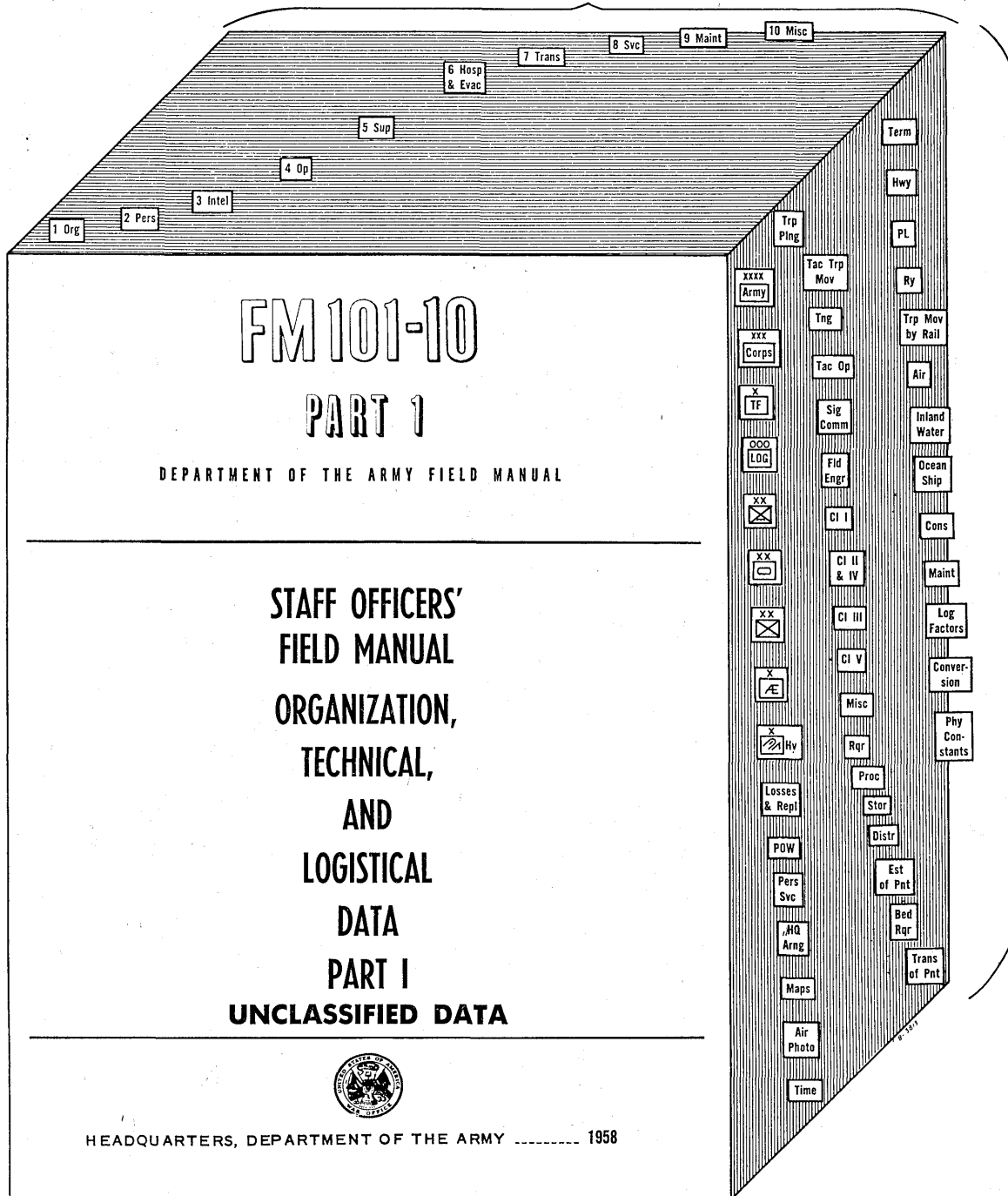


HEADQUARTERS, DEPARTMENT OF THE ARMY

FEBRUARY 1959

SUGGESTED METHOD OF PLACING INDEX TABS

Place Chapter Number Tabs on Top of Manual



Place
Section
Tabs
Along
Right
Edge
of
Manual

Chapter number and abbreviated title appear at the top of the page and are attached to the first page of the chapter. (Chapter separators of cover stock may be inserted between chapters if desired.) Abbreviated section titles within a chapter appear at the side of the manual and are attached to the page on which the particular section begins.

FOREWORD

FM 101-10, *Staff Officers' Field Manual—Organization, Technical, and Logistical Data*, consists of three parts published as separate volumes.

Part I —Unclassified Data

Part II —Extracts of Tables of Organization and Equipment

Part III—Classified Data (under preparation)

PART I

This volume is for use as a planning guide only. It provides general planning data for staff officers of all echelons. Detailed reference data are found in tables of organization and equipment, field manuals, technical manuals, technical bulletins, and supply bulletins as outlined in DA pamphlets in 310-series. The principles and procedures of administration are contained in FM 100-10; the duties of staff officers and the principles and procedures of staff action are contained in FM 101-5.

When tons are shown, the short ton (2,000 lb) is intended unless the long ton (2,240 lb) or the measurement ton (40 cu ft) is specified.

Caution: Data contained in this volume are based on experience principally from World War II and Korea, and can be applied to the future only with judgment and discrimination. Whenever a known factor is available, it should be used instead of one from this manual.

Tables and examples in chapters 1 through 9 are not, in all cases, based on latest tables of organization and equipment, and computations must be adjusted accordingly.

All agencies will institute a continuing review of the contents of this manual and submit recommendations for changes or revision direct to Commandant, United States Army Command and General Staff College, Fort Leavenworth, Kansas, within 45 days after receipt of this publication, and thereafter as changes to TOE, equipment, or data affect contents of the manual.

United States Army Command and General Staff College will prepare and process changes to this manual on a regularly scheduled quarterly basis.

U.S. 5-091-99

STAFF OFFICERS' FIELD MANUAL

ORGANIZATION, TECHNICAL, AND LOGISTICAL DATA

		Paragraphs	Page
CHAPTER	1. ORGANIZATION		
Section	I. General.....	1.1—1.4	3
	II. Field army, corps, task force, and logistical command.....	1.5—1.8	6
	III. Airborne division.....	1.9—1.11	15
	IV. Armored division.....	1.12—1.14	19
	V. Infantry division.....	1.15—1.17	28
	VI. Engineer amphibious support command.....	1.18—1.21	38
	VII. United States Army missile command (heavy).....	1.22—1.25	43
CHAPTER	2. PERSONNEL		
Section	I. General.....	2.1	49
	II. Losses and replacements.....	2.2—2.7	49
	III. Prisoner of war capture rates.....	2.8—2.10	66
	IV. Personnel services.....	2.11—2.13	67
	V. Internal arrangement of headquarters.....	2.14—2.17	68
CHAPTER	3. INTELLIGENCE		
Section	I. General.....	3.1	75
	II. Maps.....	3.2—3.9	75
	III. Aerial photography.....	3.10	93
	IV. Time, tide, and light.....	3.11—3.13	98
CHAPTER	4. OPERATIONS		
Section	I. Troop planning.....	4.1—4.7	105
	II. Tactical troop movements.....	4.8—4.13	131
	III. Training.....	4.14—4.17	179
	IV. Tactical operations.....	4.18, 4.19	182
	V. Signal communications.....	4.20—4.26	192
	VI. Field engineering.....	4.27—4.34	203
CHAPTER	5. LOGISTICS—SUPPLY		
Section	I. General.....	5.1, 5.2	221
	II. Class I supply.....	5.3, 5.4	222
	III. Class II and IV supply—dimensions and weights.....	5.5—5.12	223
	IV. Class III supply.....	5.13—5.23	239
	V. Class V supply.....	5.24—5.39	256
	VI. Miscellaneous supply.....	5.40—5.45	292
	VII. Requirements.....	5.46—5.56	266
	VIII. Procurement.....	5.57	311
	IX. Storage.....	5.58—5.68	312
	X. Distribution.....	5.63—5.79	321
CHAPTER	6. LOGISTICS—EVACUATION AND HOSPITALIZATION		
Section	I. Estimate of patients.....	6.1—6.5	336
	II. Bed requirements.....	6.6—6.9	339
	III. Transportation of patients.....	6.10, 6.11	341
CHAPTER	7. LOGISTICS—TRANSPORTATION		
Section	I. General.....	7.1—7.4	343
	II. Terminals.....	7.5—7.9	345
	III. Highway transport.....	7.10—7.15	358
	IV. Pipelines.....	7.16, 7.17	363
	V. Railways.....	7.18—7.28	364
	VI. Movement of troop units by rail.....	7.29—7.41	368
	VII. Air transportation.....	7.42—7.45	376
	VIII. Inland waterways.....	7.46—7.48	391

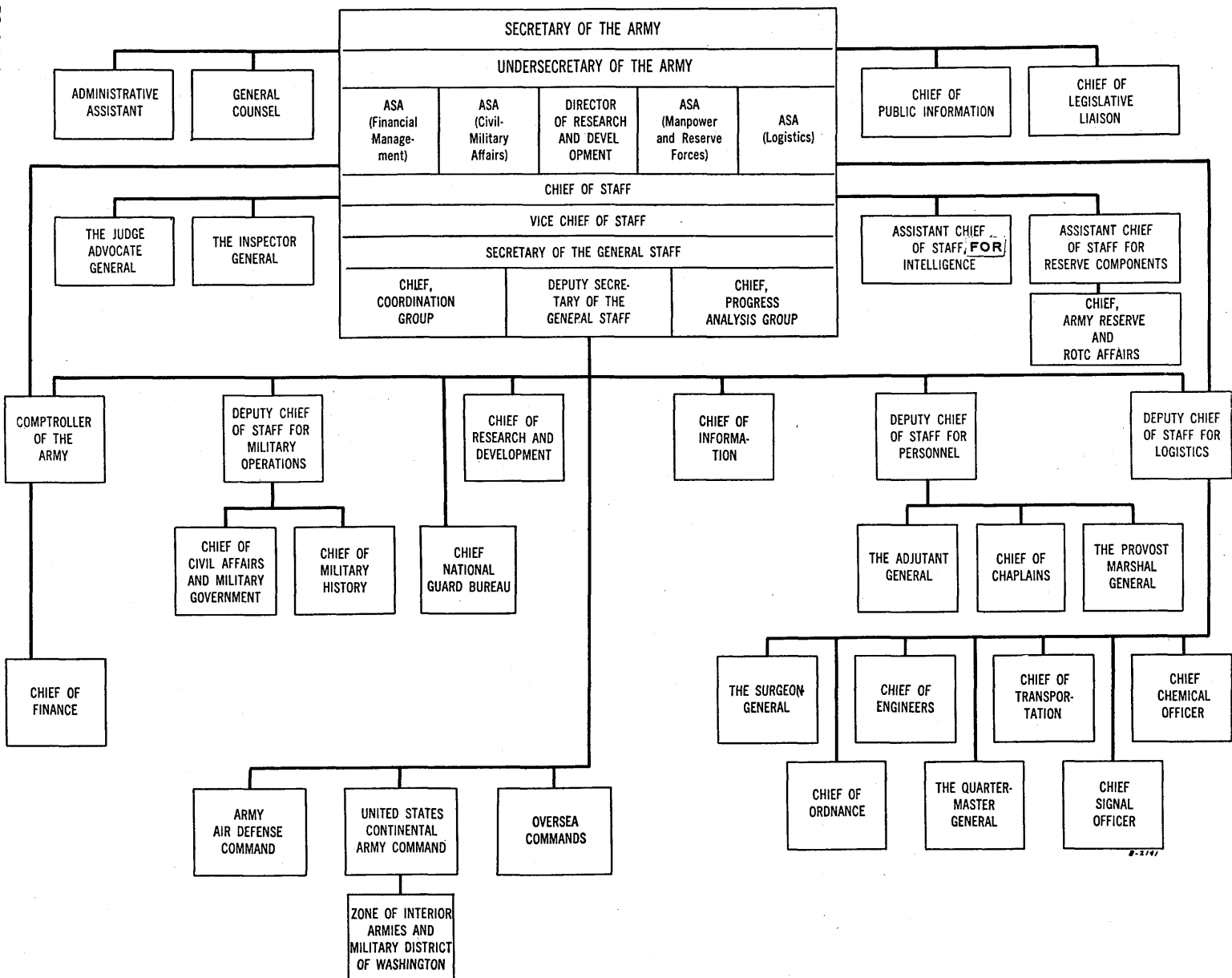
*This manual supersedes FM 101-10, 6 September 1956, including C 1, 27 August 1957 and C 2, 3 January 1958.

		Paragraphs	Page
Section	IX. Ocean shipping.....	7.49—7.56	392
	X. Miscellaneous transport.....	7.57—7.61	404
CHAPTER	8. LOGISTICS—SERVICE		
Section	I. General.....	8.1—8.3	408
	II. Construction.....	8.4—8.13	409
	III. Maintenance.....	8.14	431
CHAPTER	9. LOGISTICS—MANAGEMENT		
Section	I. General.....	9.1, 9.2	432
	II. Logistical factors.....	9.3—9.8	432
CHAPTER	10. MISCELLANEOUS		
Section	I. Conversion factors.....	10.1—10.7	437
	II. Physical constants.....	10.8—10.13	939
APPENDIX.	REFERENCES.....		440
INDEX.....			443

CHAPTER 1 ORGANIZATION

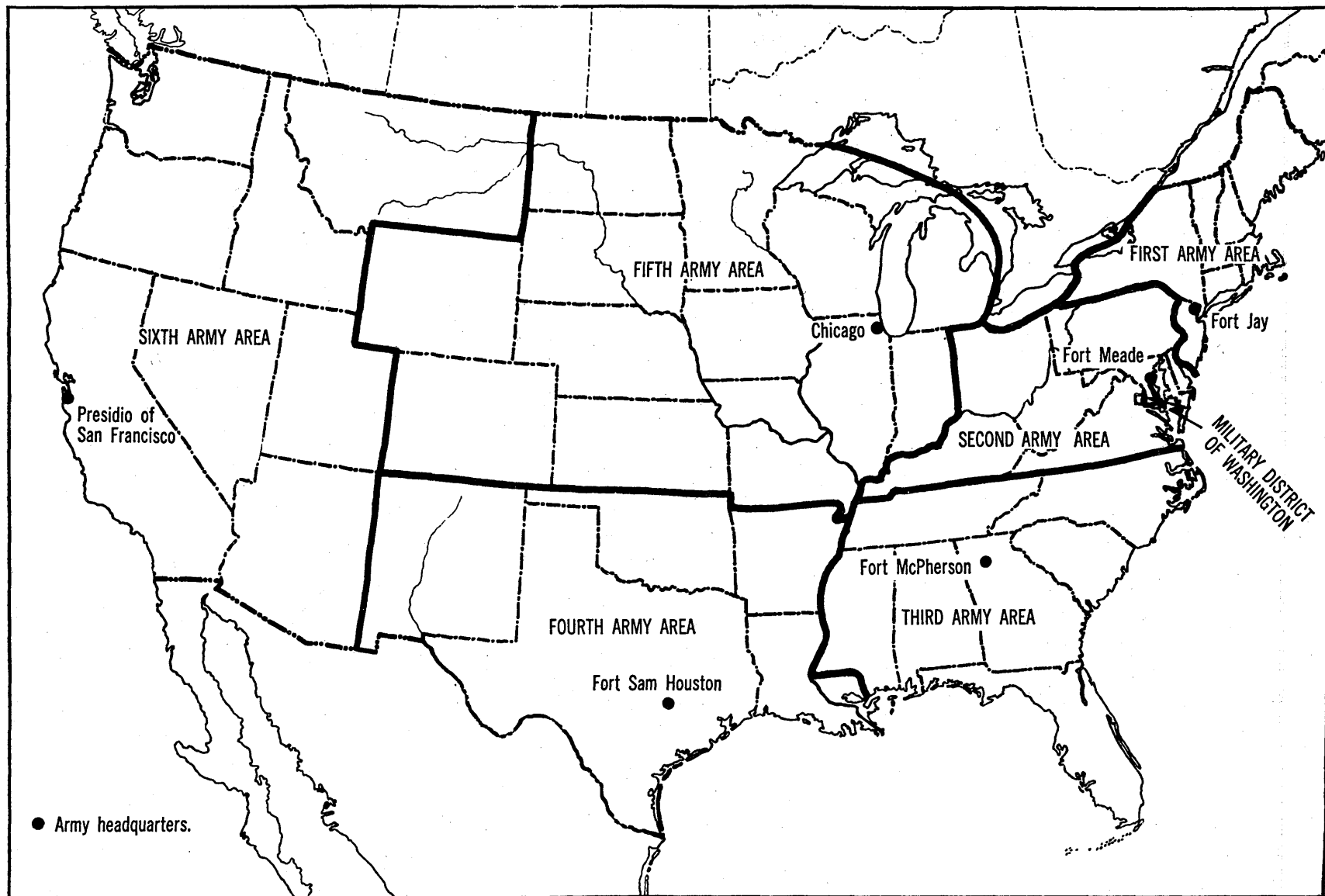
Section I. GENERAL

I.1. Department of the Army—Organization

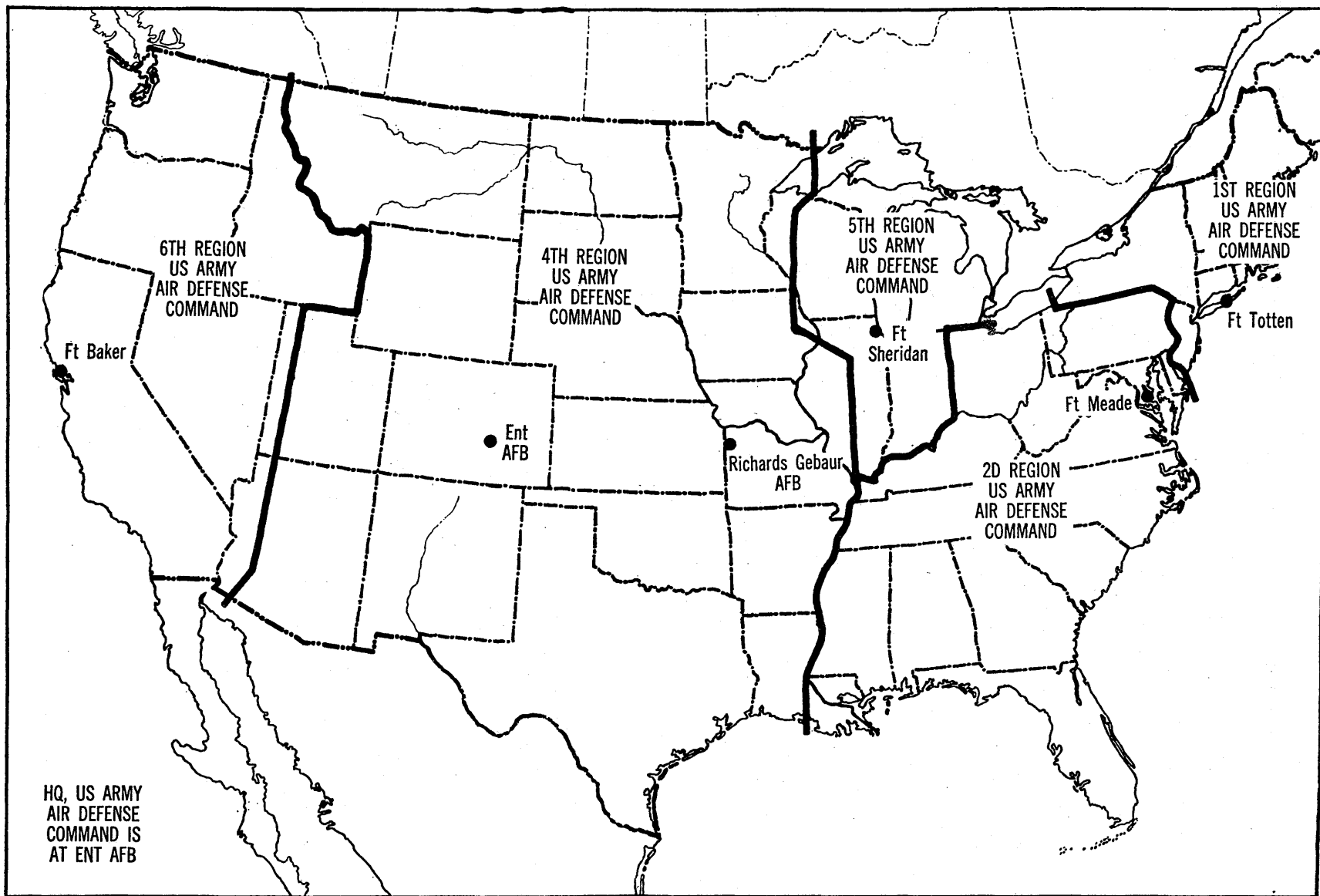


1.2. Army Areas and U. S. Army Air Defense Commands

a. Army Areas.



b. U. S. Army Air Defense Commands.



1.3. Theater Army

a. General. United States theater army headquarters is the senior United States Army headquarters in a theater of operations. In a theater where only United States forces comprise the theater command, United States theater army headquarters is charged with the overall supervision of strategic, tactical, administrative, and logistical operations of all United States Army elements. When the theater is organized as a combined command, United States theater army headquarters becomes, for all practical purposes, an administrative headquarters for the support of United States Army forces only.

b. Composition.

- (1) *Headquarters.* There is no prescribed organization for headquarters, theater army. It consists of the headquarters elements necessary to provide command and control of assigned forces. The allotment and grouping of these forces is based upon the mission assigned.
- (2) *Assigned forces.* Forces assigned to United States theater army may consist of—
 - (a) Combat forces—army groups, field armies, separate corps, and, in some cases, divisions.
 - (b) Theater army logistical command

with its subordinate logistical commands.

- (c) Theater army replacement and training command.
- (d) Civil affairs/military government command.
- (e) Army air defense commands.

1.4. Army Group

a. General. The army group is organized to direct the strategic and tactical operations of two or more field armies or similar tactical groupings. When only United States forces comprise the theater command, army group, if employed, operates under the direct control of the United States theater army commander. When operating as a part of a multinational theater, strategic direction may originate in a superior land force headquarters.

b. Composition.

- (1) *Headquarters.* There is no prescribed organization for headquarters, army group. It is provided the headquarters elements necessary to exercise strategic and tactical control of its assigned forces. Army group does not normally operate administrative installations.
- (2) *Assigned forces.* Forces assigned to an army group may consist of—
 - (a) Field armies.
 - (b) Separate corps.
 - (c) Divisions.

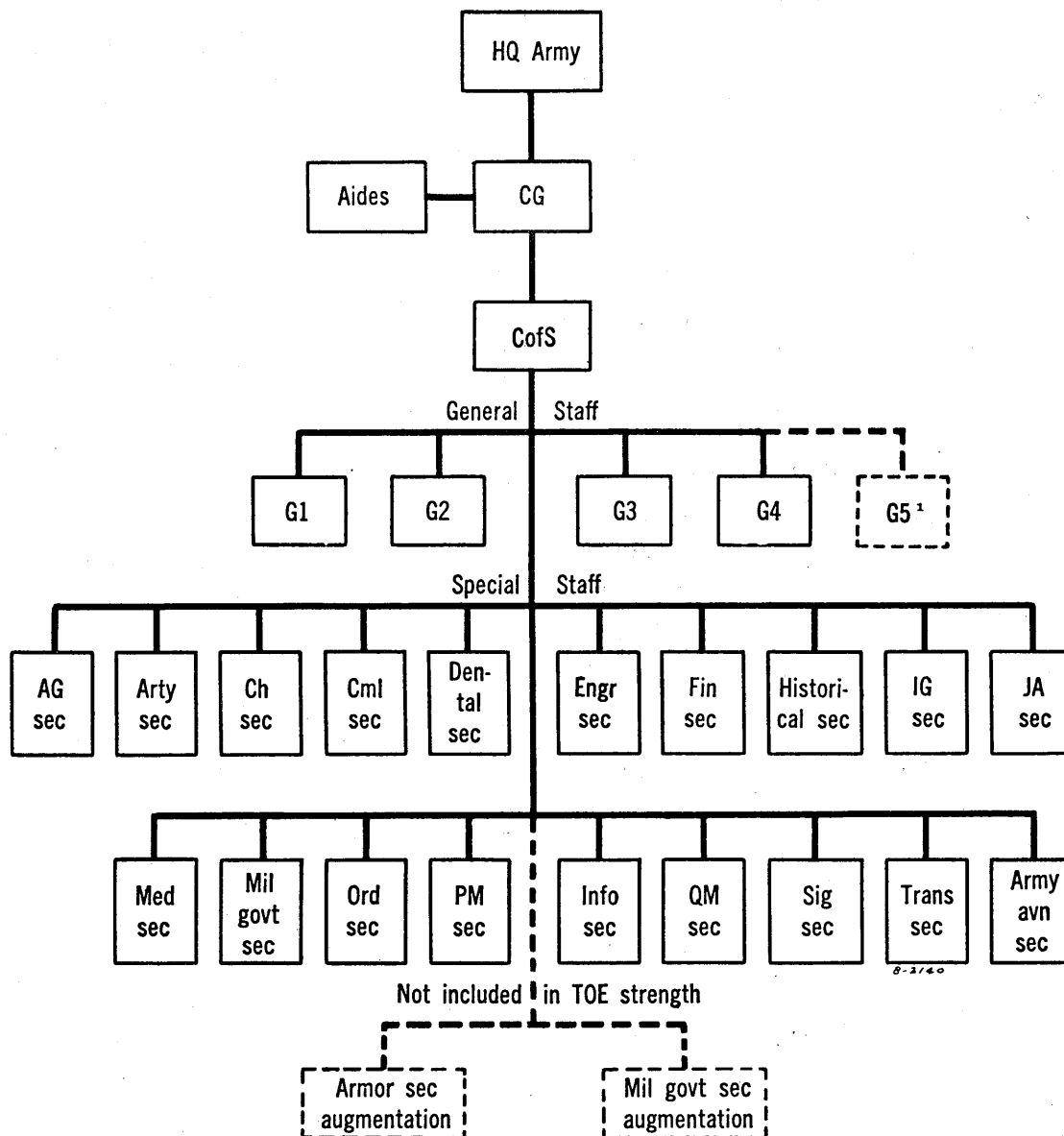
Section II. FIELD ARMY, CORPS, TASK FORCE, AND LOGISTICAL COMMAND

1.5. Field Army

a. General. The field army is a flexible combat force capable of independent operations. Normally, it consists of a headquarters, organic

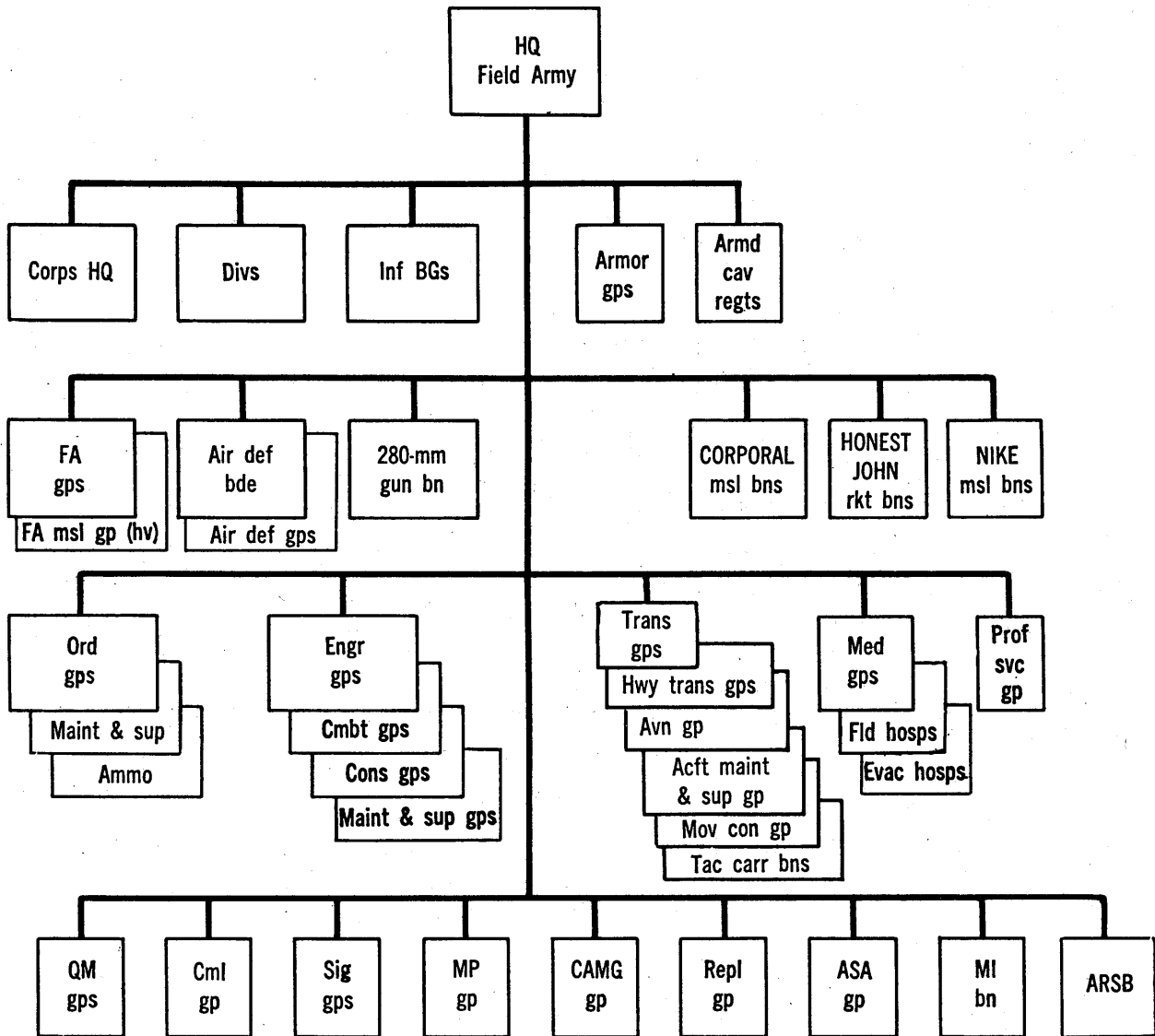
army troops, two or more corps, and reinforcing combat and service troops. A field army normally exercises both tactical and administrative functions.

b. Diagram of Field Army Headquarters, TOE 51-1C.



¹ Normally established in time of war. May or may not be established in time of peace.

c. *Diagram of a Type Field Army Combat and Service Troops.* For composition of a type field army by branch, see paragraphs 4.2 and 4.7.



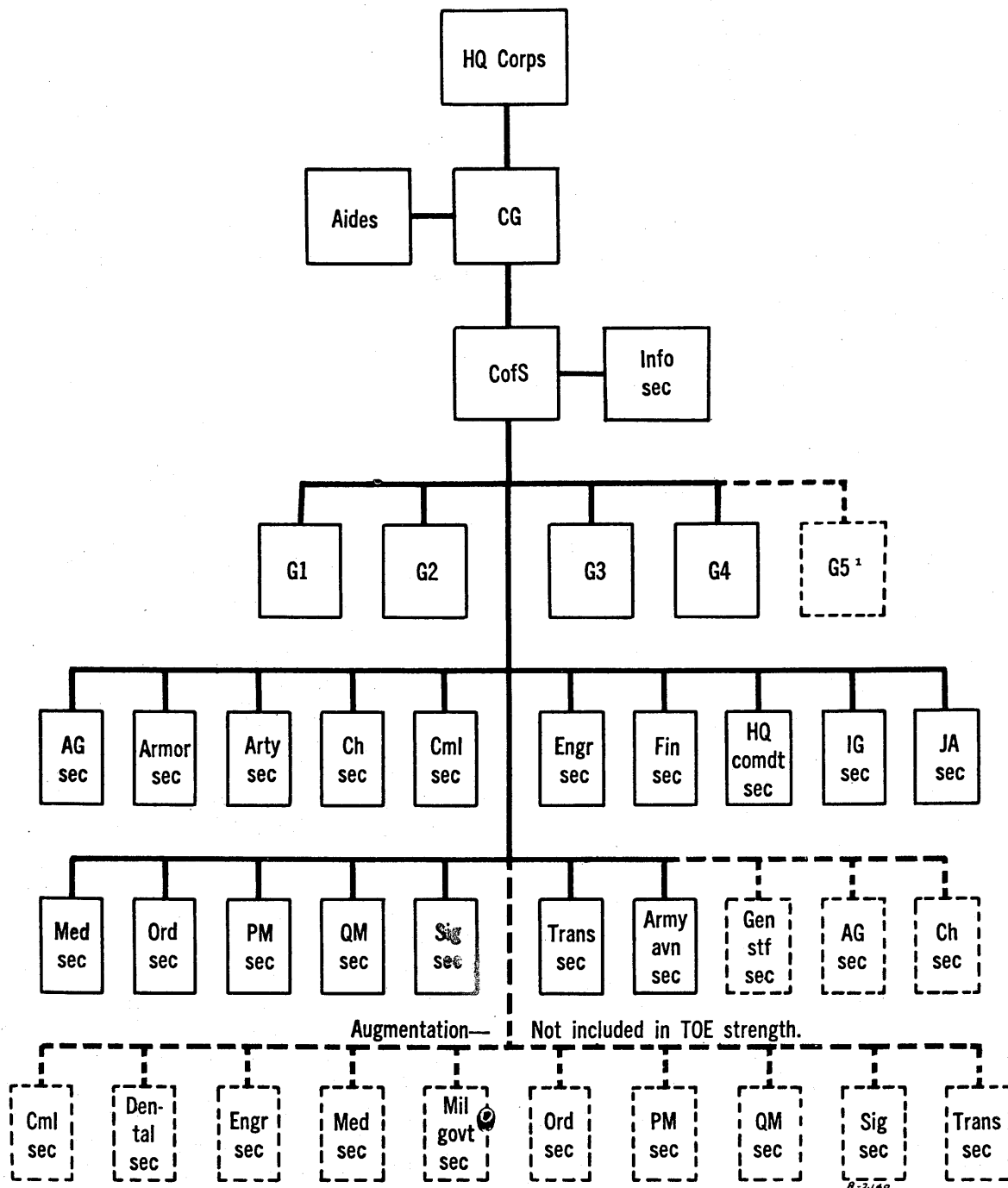
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1.6. Corps

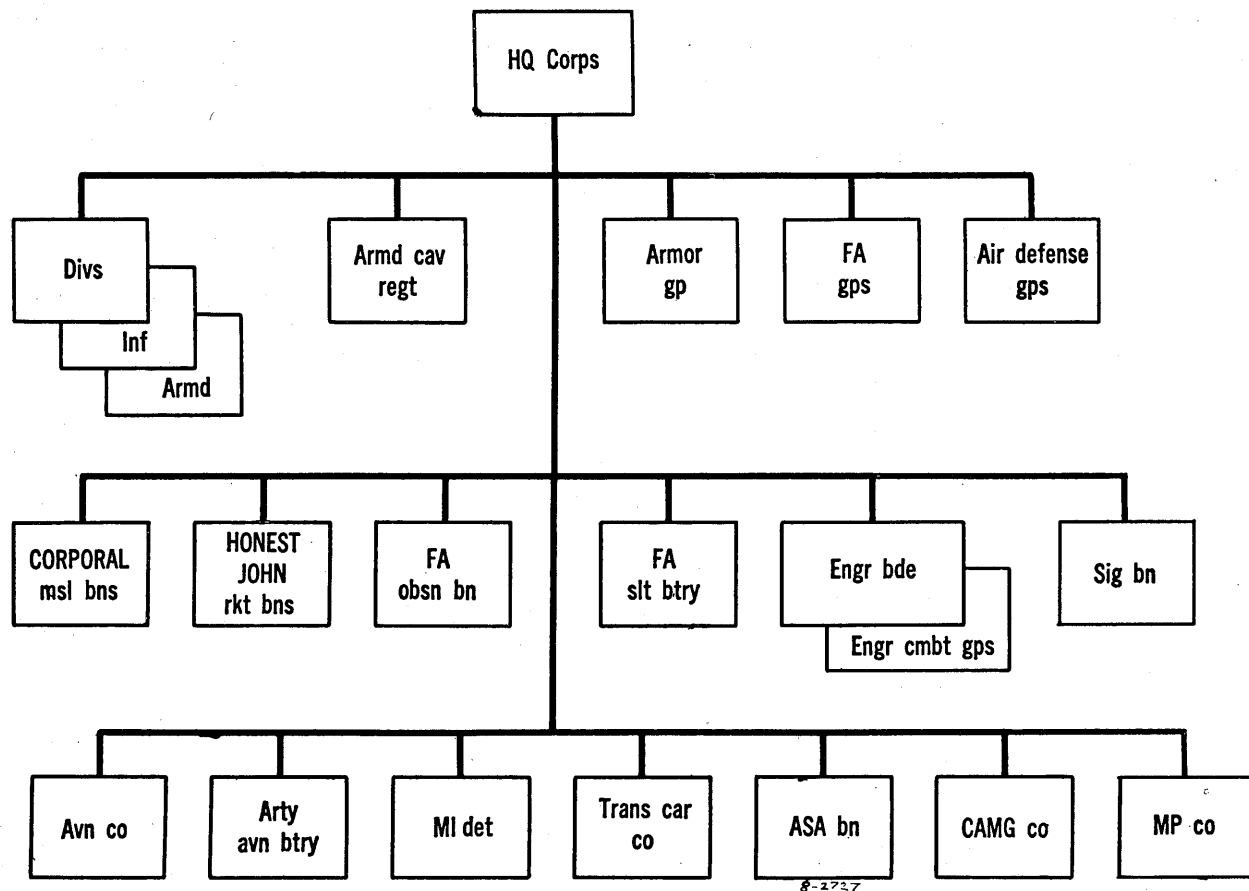
a. *General.* The corps is a flexible combat force consisting of a headquarters, organic and assigned corps troops, two or more attached divisions, and reinforcing combat and service troops that may be attached in accordance with

its mission. The functions of a corps in a field army are primarily tactical. The functions of a separate corps are both tactical and administrative.

b. *Diagram of Corps Headquarters, TOE 52-1C.*



¹ Normally established in time of war. May or may not be established in time of peace.



1.7. Task Force

A task force consists of those units (command, intelligence, combat, and service) necessary to carry out certain planned operations (tasks). It has no fixed organization and may be organized from Army, Navy, or Air Force units, or it may be a combination of any 2 or of all 3. (See FM 110-5.) A task force designed for one operation might be especially strong in armored units; in another, amphibious units might be predominant.

1.8. Logistical Commands

a. *General.* The logistical command is a highly flexible organization consisting of a headquarters and headquarters company and a balanced force of service units organized to execute a specific administrative or logistical support mission, augmented by tactical units if required for rear area defense. The logistical command is normally assigned to the communications zone, but may be assigned or attached

to a separate field army or an independent task force for the purpose of operating a service command in support thereof.

b. *Headquarters, Logistical Command.* A headquarters and headquarters company is organic to the logistical command. The organization of these headquarters is flexible and should be tailored to fit the mission assigned. The staff organization will be designed to fit the responsibilities of the command.

c. *Service Units.* Service units of the required numbers and types are assigned or attached as necessary to accomplish the assigned mission. Service units will normally be organized along technical and administrative service lines.

d. *TOE Type Headquarters.* At the present time, there are three types of TOE headquarters and headquarters company, logistical commands (types A, B, and C). These headquarters are available to provide the nuclei for organizing logistical commands. These headquarters

are designed to command and control service forces as indicated below.

(1) *Logistical command type A (TOE 54-1 and 54-2).*

(a) *Organization chart for headquarters, logistical command A.*

(b) *Capabilities.*

1. When provided with appropriate service forces, to furnish army and communications zone support to a combat force of approximately 30,000 men by—

- (a) Operating an army service command.
- (b) Operating a small section (advance or base) of a communications zone.
- (c) Operating a major territorial subdivision of one of the above,

such as a base, a district, or an area.

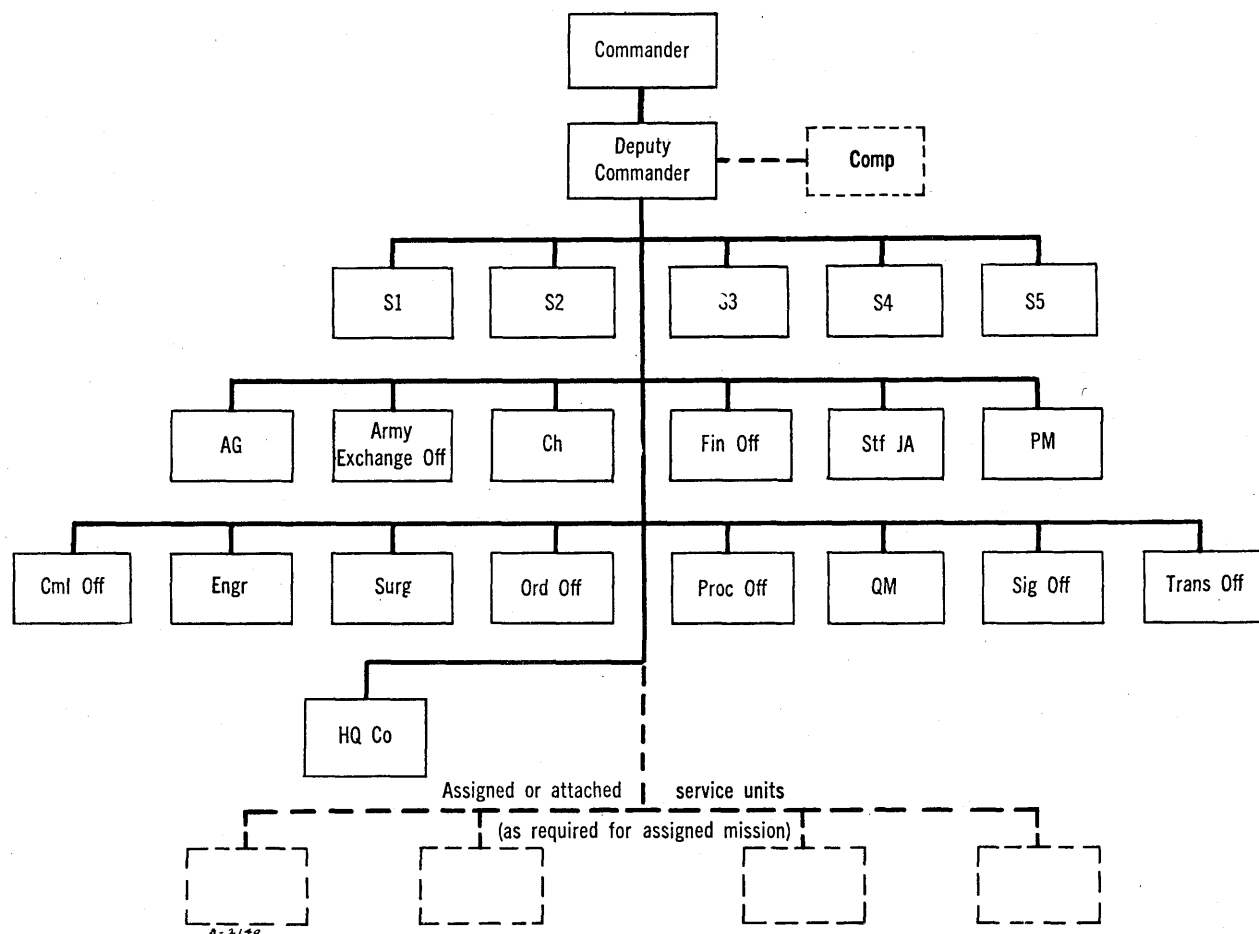
2. Administration and rehabilitation of an area in which civil means are inadequate because of natural disaster or enemy action.

(c) *Strength.*

1. Headquarters and headquarters company, logistical command A:
Off 55 ANC 1 WO 4
EM 122 Agg 182.

2. Logistical command A: Agg 182 plus assigned or attached service forces (9,000 to 15,000).

(d) *Basis of allocation.* One per supported force of approximately 30,000 troops when required to provide administrative support; or 1 per separate administrative or logistical mission, as required.



- (e) *Mobility*. Fixed.
- (2) *Logistical command type B (TOE 54-101 and 54-102)*.
- (a) *Organizational chart for headquarters, logistical command B.*
- (b) *Capabilities.*

1. When provided with appropriate service forces, to provide communications zone support to a combat force of approximately 100,000 men by—

- (a) Operating a small section (advance or base) of a communications zone.
- (b) Operating a major territorial subdivision of one of the above,

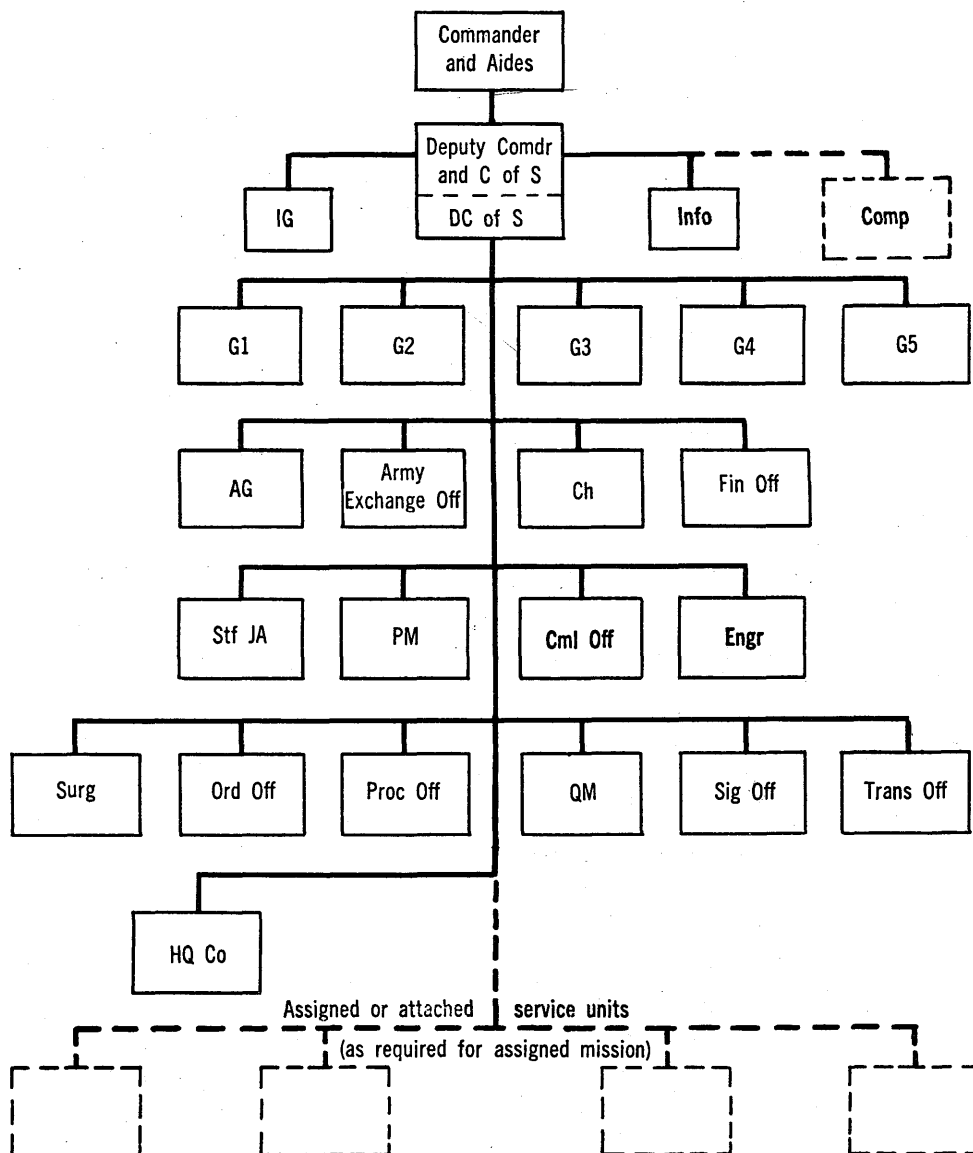
such as a base, a district, or an area.

2. Administration and rehabilitation of an area in which civil means are inadequate because of natural disaster or enemy action.

(c) *Strength.*

1. Headquarters and headquarters company, logistical command B:
Off 117 ANC 1 WO 17
EM 222 Agg 357.
2. Logistical command B: Agg 357 plus assigned or attached service forces (35,000 to 60,000).

(d) *Basis of allocation.* One per supported force of approximately



100,000 troops when required to provide administrative support; or 1 per separate administrative or logistical mission, as required.

(e) *Mobility.* Fixed.

(3) *Logistical command type C (TOE 54-201 and 54-202).*

(a) *Organizational chart for headquarters, logistical command C.*

(b) *Capabilities.*

1. When provided with appropriate service forces, to provide com-

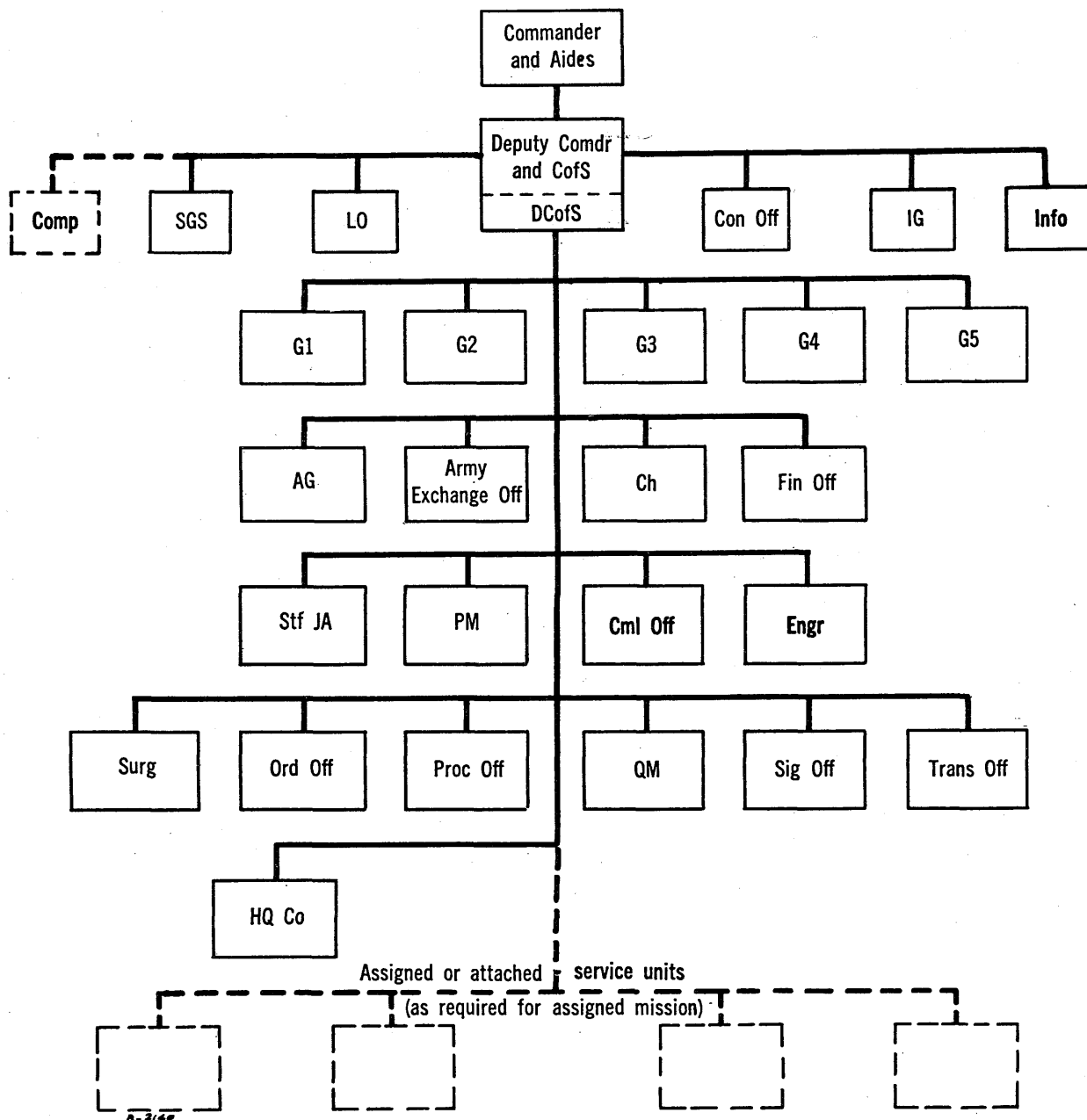
munications zone support to a field army.

(a) Operating a section (advance or base) of a communications zone.

(b) Operating a major territorial subdivision of one of the above, such as a base, a district, or an area.

(c) Operating a small, undivided communications zone.

2. Administration and rehabilitation



of an area in which civil means are inadequate because of natural disaster or enemy action.

(c) *Strength.*

1. Headquarters and headquarters company, logistical command C:
Off 171 ANC 1 WO 24
EM 309 Agg 505.
2. Logistical command C: Agg 505

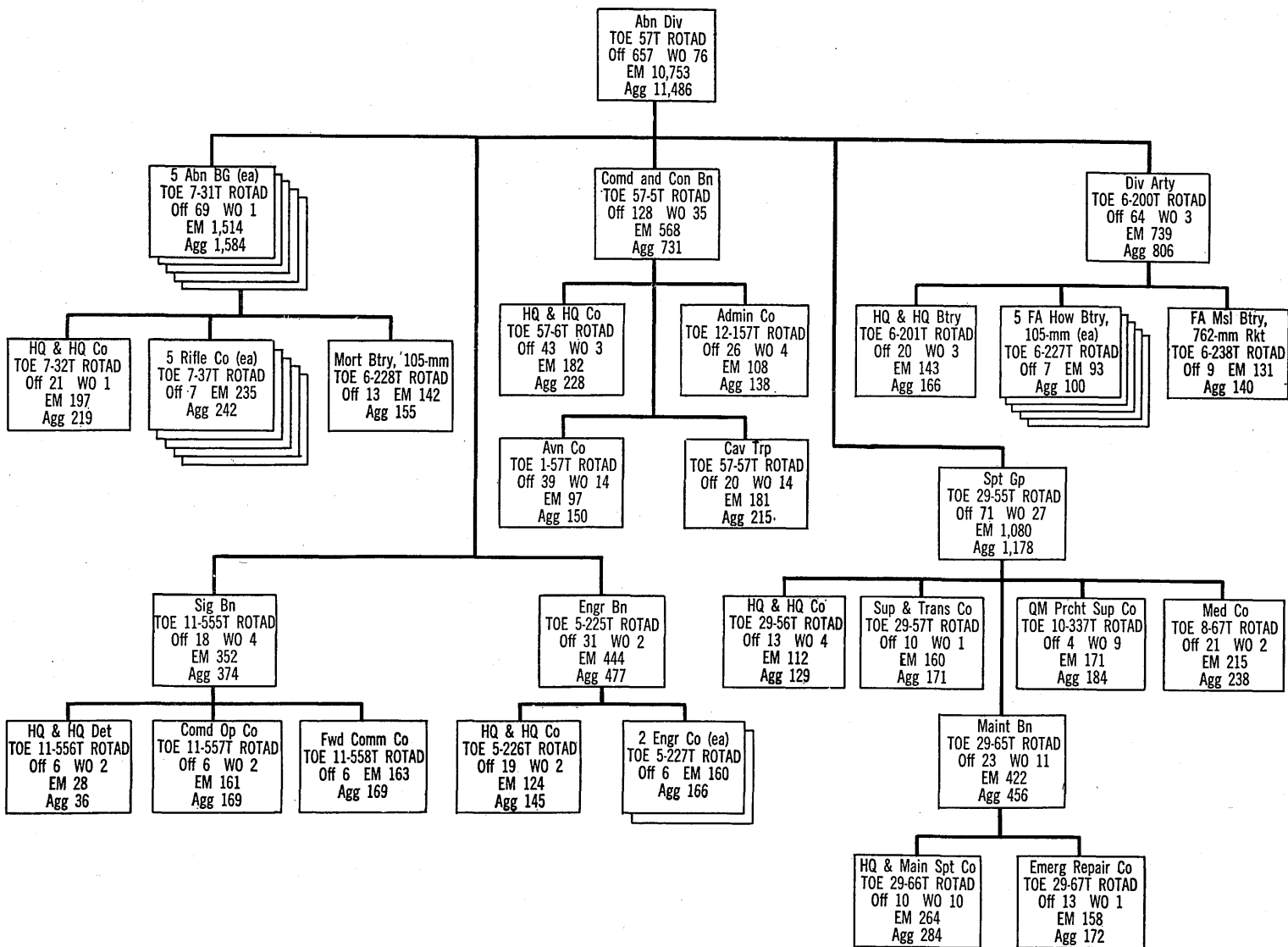
plus assigned or attached service forces (75,000 to 150,000).

- (d) *Basis of allocation.* One per supported force of approximately 400,000 troops when required to provide administrative support; or 1 per separate administrative or logistical mission, as required.

- (e) *Mobility.* Fixed.

Section III. AIRBORNE DIVISION

1.9. Airborne Division—Organization



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1.10. Airborne Division—Weapons (TOE 57T)

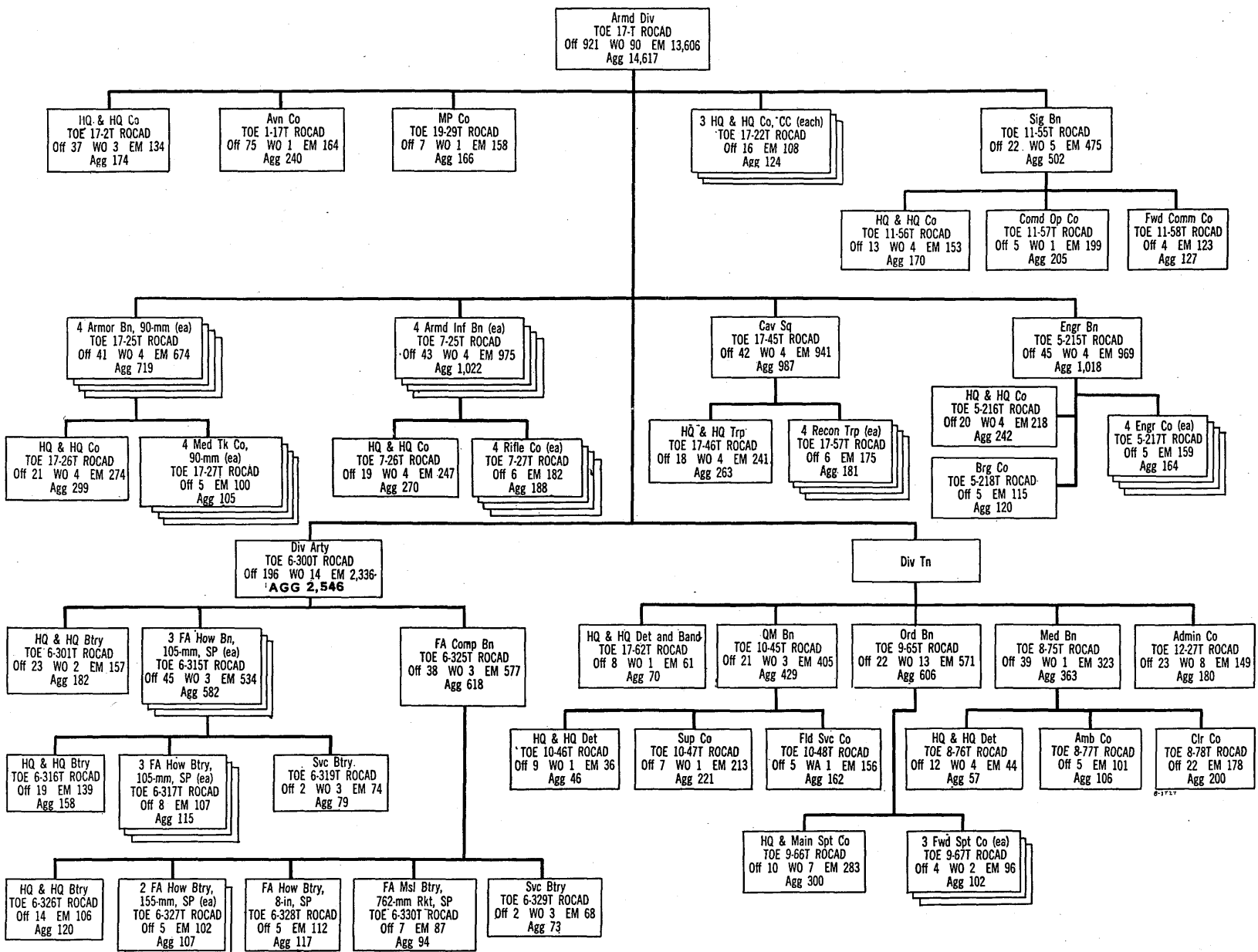
1		2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	
Weapons		Total abn div	Comd & con bn					Sig bn				Abn BG (5) (ea)				Engr bn			Div arty				Spt gp								
			Total bn	HQ & HQ co	Admin co	Avn co	Cav trp	Total bn	HQ & HQ det	Comd op co	Fwd comm co	Total BG	HQ & HQ co	Mort btry, 105-mm	5 rifle co (ea)	Total bn	HQ & HQ co	2 engr co (ea)	Total div arty	HQ & HQ btry	5 FA how btry, 105-mm (ea)	FA msl btry, 762-mm rkt	Total gp	HQ & HQ co	QM preht sup co	Maint bn				Sup & trans co	Med co
																										Total bn	HQ & main spt co	Emerg rep co	Sup & trans co		
1	Carbine, cal .30, M2	4,494	(433)	191	87	55	100	(127)	18	70	39	(454)	80	154	44	(122)	48	37	(786)	152	99	139	(756)	78	113	(270)	172	98	94	201	
2	Gun, machine, cal .30, M1919A4	10	(10)				10																								
3	Gun, machine, cal .30, M1919A6	409	(4)		4			(15)			15	(56)	10	6	8	(30)	12	9	(38)	6	4	12	(42)	3		(39)		39			
4	Gun, machine, cal .50, M2	5	(1)		1			(2)		1	1												(2)			(2)	2				
5	Gun, submachine, cal .45, M3A1	173	(7)		7			(70)	4	41	25					(64)	14	25					(32)		3	(23)	11	12	6		
6	Gun, 90-mm, SP, full-tracked, M56	30										(6)	6																		
7	Howitzer, 105-mm	25																	(25)		5										
8	Launcher, 762-mm rkt	4																	(4)		4										
9	Launcher, rkt, 3.5-in	460	(13)	6	3		4	(10)	1	3	6	(73)	3	15	11	(10)		5	(42)	9	5	8	(20)	2	1	(9)	6	3	8		
10	Mortar, 81-mm, M21	52	(2)				2					(10)			2																
11	Mortar, 4.2-in, M2	40										(8)		8																	
12	Pistol, cal .45, M1911A1	1,158	(144)	37	12	51	44	(4)	4			(190)	9	1	36	(8)	8		(19)	13	1	1	(33)	4	1	(11)	5	6	2	15	
13	Rifle, auto, cal .30, M1918A2	660	(10)				10					(120)			24	(48)		24					(2)	2							
14	Rifle, US, cal .30, M1	4,080	(126)		30	44	52	(173)	10	58	105	(638)	128		102	(235)	75	80					(356)	46	67	(152)	96	56	69	22	
15	Rifle, US, cal .30, M1C (snipers)	303	(3)				3					(60)			12																
16	Rifle, 106-mm, on mount, recoilless	54	(4)				4					(10)			2																
17	Individual weapons	10,868	(723)	228	136	150	209	(374)	36	169	169	(1,462)	217	155	218	(477)	145	166	(805)	165	100	140	(1,179)	130	184	(456)	284	172	171	238	
18	Crew-served weapons	1,089	(34)	6	8		20	(27)	1	4	22	(163)	19	29	23	(40)	12	14	(109)	15	14	24	(64)	5	1	(50)	8	42	8	0	
19	Total weapons	11,957	(757)	234	144	150	229	(401)	37	173	191	(1,625)	236	184	241	(517)	157	180	(914)	180	114	164	(1,243)	135	185	(506)	292	214	179	238	

1.11. Airborne Division—Vehicles and Major Equipment (TOE 57T)

1		2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Item	Total abn div	Comd & con bn				Sig bn			Abn BG 5 (e)			Engr bn		Div arty			Spt gp													
		Total bn	HQ & HQ co	Admin co	Avn co	Cav trp	Total bn	HQ & HQ det	Comd op co	Fwd comm co	Total BG	HQ & HQ co	Mort btry, 105-mm	5 rifle co (ea)	Total bn	HQ & HQ co	2 engr co (ea)	Total div arty	HQ & HQ btry	5 FA how btry, 105-mm (ea)	FA msl btry, 762-mm rkt	Total gp	HQ & HQ co	QM prcht sup co	Maint bn			Sup & trans co	Med co	
																									Total bn	HQ & main spt co	Emerg rep co			
AIRCRAFT																														
1	Airplane, observation	10	(10)			10																								
2	Airplane, utility	6	(6)			6																								
3	Helicopter, utility	20	(20)			20																								
4	Helicopter, recon	17	(17)			17																								
TRACKED VEHICLES																														
5	Tractor, full track, low speed, diesel 8,600-12,000 DBP	2														(2)	2													
6	Tractor, full track, low speed, diesel 12,000-17,000 DBP	4														(4)	4													
7	Gun, 90-mm, SP, full track, antitank, abn	30										(6)	6																	
WHEELED VEHICLES																														
8	Carrier, lt, wpns, inf, XM 274	615	(1)	1			(5)		5		(110)	5	25	16	(49)	1	24	(1)	1			(9)			(5)	4	1	4		
9	Crane, abn, 7½-ton, ½ cu yd	3													(3)	3														
10	Grader, road, diesel 7,000-8,975 lb	3													(3)	3														
11	Launcher, 762-mm rkt, trk mtd, 5-ton	4															(4)			4										
12	Tractor, 4-wheel	4													(4)	4														
13	Tractor, wheeled w/bucket loader	2													(2)	1														
14	Tractor, whse, 6,000 lb 4-wheel	3																			(3)		2						1	
15	Truck, ¼-ton, litter	33	(1)	1											(1)	1		(1)	1			(30)								30
16	Truck, ¼-ton, 4 x 4, XM 151	420	(69)	34	11	3	21	(11)		6	5	(41)	24	7	2	(20)	10	5	(67)	17	7	15	(48)	7	2	(21)	8	13	4	14
17	Truck, ¾-ton, 6 x 6, XM 408	366	(39)	6		23	10	(54)	4	30	20	(25)	15	10		(9)	7	1	(77)	15	10	12	(62)	2	3	(41)		41	4	12
18	Truck, ambulance, frontline, ¼-ton, 4 x 4	30										(6)	6																	
19	Truck, cargo, 2½-ton, 6 x 6, LWB	101	(9)	2	3	1	3	(2)		1	1	(4)	4			(3)	1	1	(12)	2	1	5	(55)	1	4	(10)	9	1	37	3
20	Truck, cargo, 2½-ton, 6 x 6, LWB, w/winch	21	(1)		1							(3)	3									(5)		1					4	
21	Truck, cargo, 2½-ton, 6 x 6, SWB, w/winch	7																(7)	7											
22	Truck, cargo, 5-ton, 6 x 6, XLWB	8																(8)			8									
23	Truck, dump, 2½-ton, 6 x 6, LWB	12													(12)	8	2													
24	Truck, tank, gasoline, 2½-ton, 6 x 6, LWB	2	(2)		2																									
25	Truck, wrecker, lt, 2½-ton, 6 x 6	1																				(1)			(1)	1				
26	Truck, wrecker, med, 5-ton, 6 x 6, w/winch	5																(4)			4			(1)		(1)	1			
27	Truck, van, shop, 2½-ton, 6 x 6	1																				(1)			(1)	1				
28	Truck, wrecker, ¾-ton, 6 x 6	9																				(9)			(9)	2	7			

1		2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Item	Total abn div	Comd & con bn				Sig bn			Abn BG 5 (e)			Engr bn		Div arty			Spt gp													
		Total bn	Hq & Hq co	Admin co	Avn co	Cav trp	Total bn	Hq & Hq det	Comd op co	Fwd comm co	Total BG	Hq & Hq co	Mort btry, 105-mm	5 rifle co (ea)	Total bn	Hq & Hq co	2 engr co (ea)	Total div arty	Hq & Hq btry	5 FA how btry, 105-mm (ea)	FA msl btry, 762-mm rkt	Total gp	Hq & Hq co	QM preht sup co	Maint bn					
																									Total bn	Hq & main spt co	Emerg rep co	Sup & trans co	Med co	
WHEELED VEHICLES—Continued																														
29	Truck, fork, 15,000 lb.....	2																					(2)		2					
30	Truck, lift, fork, 6,000 lb.....	7																				(7)		4					3	
TRAILERS																														
31	Compressor, air, trailer, 2-wheel, 105 CFM.....	3														(3)	1	1												
32	Erdlator, trailer mtd.....	4														(4)	4													
33	Trailer, 762-mm rkt.....	8																	(8)		8									
34	Trailer, amph, cargo, ¼-ton, 2-wheel.....	279	(41)	19	11	3	8	(6)	--	1	5	(27)	12	5	2	(11)	9	1	(45)	8	5	12	(41)	7	2	(16)	8	8	4	12
35	Trailer, cargo, ¾-ton, 2-wheel.....	243	(36)	4	23	--	9	(21)	2	19	--	(17)	9	8	--	--	--	(39)	10	4	9	(62)	2	3	(41)	--	41	4	12	
36	Trailer, cargo, 1½-ton, 2-wheel.....	95	(6)	2	3	--	1	--	--	--	--	(5)	5	--	(5)	3	1	(7)	7	--	--	(52)	--	4	(7)	7	--	40	1	
37	Trailer, tank, water, 1½-ton, 2-wheel.....	34	(4)	1	1	1	1	(2)	--	1	1	(2)	2	--	(3)	1	1	(8)	2	1	1	(7)	1	1	(2)	1	1	1	2	
38	Trailer, whse, 6,000 lb, 5-wheel.....	18																			(18)	--	12							
39	Trailer, bolster, 2½-ton.....	3														(3)	3													
40	Scraper, road, towed, 7½ cu yd.....	4														(4)	4													
41	Welding eqp, set No. 1,300 amp, trailer mtd.....															(1)	1													
42	Total trailers.....	692	(87)	26	38	4	19	(29)	2	21	6	(51)	28	13	2	(34)	26	4	(107)	27	10	30	(180)	10	22	(66)	16	50	55	27
43	Total sp veh (less aircraft).....	1,695	(122)	44	17	27	34	(72)	4	42	26	(195)	63	42	18	(112)	44	34	(181)	43	18	48	(233)	10	18	(89)	26	63	57	59
44	Total aircraft.....	53				53																								

Section IV. ARMORED DIVISION
1.12. Armored Division—Organization



1.13. Armored Division—Weapons (TOE 17T)

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
	Weapons	Total armd div	Div trp								4 armor bn, 90-mm (ea)			4 armd inf bn (ea)			Cav sq		
			HQ & HQ co	Avn co	MP co	3 HQ & HQ co, CC (ea)	Sig bn				Total bn (ea)	HQ & HQ co	4 med tk co, 90-mm (ea)	Total bn (ea)	HQ & HQ co	4 rifle co (ea)	Total sq	HQ & HQ trp	4 recon trp (ea)
							Total bn	HQ & HQ co	Comd op co	Fwd comm co									
1	Carbine, cal .30, M2-----	3,720	88	79	27	69	(218)	87	106	25	(66)	62	1	(81)	57	6	(121)	109	3
2	Gun, machine, cal .30, M1919A4-----	315	---	4	4	---	(3)	---	---	3	(12)	12	---	(16)	16	---	(66)	2	16
3	Gun, machine, cal .30, M1919A6-----	329	3	---	---	5	---	---	---	---	(4)	4	---	(72)	---	18	(1)	1	---
4	Gun, machine, cal .30, M1919A6 (OVM)-----	452	2	---	---	2	---	---	---	---	(78)	6	18	(12)	12	---	(58)	6	13
5	Gun, machine, cal .50, M2-----	405	2	2	1	3	(12)	4	4	4	(23)	15	2	(22)	14	2	(25)	17	2
6	Gun, machine, cal .50, M2 (OVM)-----	1,074	4	---	---	8	(3)	---	3	---	(99)	19	20	(87)	15	18	(98)	14	21
7	Gun, submachine, cal .45, M3A1-----	2,011	26	---	48	4	(93)	18	41	34	(257)	93	41	(109)	61	12	(219)	79	35
8	Gun, tank, 76-mm-----	54	2	---	---	---	---	---	---	---	---	---	---	---	---	---	(52)	4	12
9	Gun, tank, 90-mm-----	306	---	---	---	2	---	---	---	---	(72)	4	17	---	---	---	---	---	---
10	Howitzer, 105-mm-----	54	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
11	Howitzer, 155-mm-----	12	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
12	Howitzer, 8-in-----	4	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
13	Launcher, 762-mm rkt-----	2	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
14	Launcher, rkt, 3.5-in-----	642	3	4	4	4	(14)	3	5	6	(37)	25	3	(70)	18	13	(10)	2	2
15	Mortar, 81-mm, M21-----	48	---	---	---	---	---	---	---	---	---	---	---	(12)	---	3	---	---	---
16	Mortar, 4.2-in., M2, (OVM)-----	40	---	---	---	---	---	---	---	---	(4)	4	---	(4)	4	---	(8)	---	2
17	Pistol, cal .45, M1911A1-----	3,013	30	76	64	29	(9)	9	---	---	(386)	58	82	(167)	39	32	(345)	61	71
18	Rifle, auto, cal .30, M1918A2-----	453	---	---	---	---	(3)	---	---	3	---	---	---	(72)	---	18	(24)	---	6
19	Rifle, US, cal .30, M1-----	6,216	31	85	63	26	(179)	56	58	65	(163)	95	17	(589)	117	118	(402)	26	94
20	Rifle, US, cal .30, MIC(snipers)-----	144	---	---	---	---	---	---	---	---	---	---	---	(36)	---	9	---	---	---
21	Individual weapons-----	15,557	175	240	202	128	(502)	170	205	127	(872)	308	141	(1,054)	274	195	(1,111)	275	209
22	Crew-served weapons-----	3,737	16	10	9	24	(32)	7	12	13	(329)	89	60	(295)	79	54	(318)	46	68
23	Total weapons-----	19,294	191	250	211	152	(534)	177	217	140	(1,200)	392	184	(1,349)	353	249	(1,429)	321	277

	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48
	Engr bn				Div arty												Div tn												
	Total bn	HQ & HQ co	4 engr co (ea)	Brg co	Total div arty	HQ & HQ btry	3 FA how bn, 105-mm, SP (ea)				FA comp bn				HQ & HQ det & band	Admin co	QM bn			Ord bn			Med bn						
							Total bn	HQ & HQ btry	3 FA how btry, 105-mm (ea)	Svc btry	Total bn	HQ & HQ btry	2 FA how btry, 155-mm, SP (ea)	FA how btry, 8-in, SP			FA msl btry, 762-mm rkt, SP	Svc btry	Total bn	HQ & HQ det	Sup co	Fld svc co	Total bn	HQ & main spt co	3 fwd spt co (ea)	Total bn	HQ & HQ det	Amb co	Clr co
1	(67)	42	5	5	(1,199)	96	(280)	79	58	27	(263)	65	41	59	34	23	54	124	(282)	26	148	108	(361)	184	59	(305)	44	96	165
2	(40)	4	9		(84)	1	(19)	2	5	2	(26)	3	6	5	4	2			(2)		2								
3																		6											
4	(14)	2	3		(8)		(2)			2	(2)					2							(4)	1	1				
5	(47)	8	5	19	(80)	6	(22)	2	5	5	(8)	1	2			3	1	(28)		14	14	(18)	6	4					
6	(57)	5	13		(131)	3	(33)	7	8	2	(29)	4	8	7		2							(13)	1	4				
7	(83)	27	13	4	(8)		(2)			2	(2)					2	4	4	(16)	5	6	5	(34)	16	6				
8																													
9	(12)		3																										
10					(54)		(18)		6																				
11					(12)						(12)		6																
12					(4)						(4)			4															
13					(2)						(2)				2														
14	(47)	5	9	6	(98)	6	(21)	6	3	6	(29)	6	2	7	8	4	4	(6)	2	3	1	(12)	6	2					
15																													
16																													
17	(58)	10	12		(67)	11	(14)	6	1	5	(14)	5	1	1	1	5	3	16	(5)	5			(16)	7	3	(25)	8		17
18					(133)	4	(32)	5	8	3	(33)	4	8	8	2	3			(5)	1	2	2							
19	(813)	166	134	111	(1,157)	67	(260)	68	48	48	(310)	46	57	49	57	44	7	36	(121)	9	65	47	(203)	95	36	(33)	5	10	18
20																													
21	(1,021)	245	164	120	(2,564)	178	(588)	158	115	85	(622)	120	107	117	94	77	68	180	(429)	46	221	162	(614)	302	104	(363)	57	106	200
22	(217)	24	42	25	(473)	16	(115)	17	27	17	(112)	14	29	23	14	13		11	(36)	2	19	15	(47)	14	11				
23	(1,238)	269	206	145	(3,037)	194	(703)	175	142	102	(734)	134	131	140	108	90	68	191	(465)	48	240	177	(661)	316	115	(363)	57	106	200

1.14. Armored Division—Vehicles and Major Equipment (TOE 17T)

1		2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
Item		Total armd div	Div trp								4 armor bn, 90-mm (ea)		4 armd inf bn (ea)			Cav sq			
			HQ & HQ co	Avn co	MP co	3 HQ & HQ co, CC (ea)	Sig bn				Total bn (ea)	HQ & HQ co	4 med tk co, 90-mm (ea)	Total bn (ea)	HQ & HQ co	4 rifle co (ea)	Total sq	HQ & HQ trp	4 recon trp (ea)
							Total bn	HQ & HQ co	Comd op co	Fwd comm co									
AIRCRAFT																			
1	Airplane, observation	19	19																
2	Airplane, utility	5	5																
3	Helicopter, transport, light	6	6																
4	Helicopter, reconnaissance	12	12																
5	Helicopter, utility	8	8																
TRACKED VEHICLES																			
6	Carrier, heavy mortar	40									(4)	4		(4)	4		(8)		2
7	Carrier, personnel, full-tracked	536	2			6	(3)		3		(17)	9	2	(77)	9	17	(32)	8	6
8	Howitzer, 105-mm, FT, SP	54																	
9	Howitzer, 155-mm, FT, SP	12																	
10	Howitzer, 8-in., FT, SP	4																	
11	Tank, recovery vehicle, medium	68									(6)	2	1	(6)	2	1	(6)	2	1
12	Tank, combat, FT, 76-mm gun	54	2														(52)	4	12
13	Tank, combat, FT, 90-mm gun	306				2					(72)	4	17						
WHEELED VEHICLES																			
14	Crane-shovel, trk mtd, 6 x 6, 20-ton, ¾ cu yd	3																	
15	Fire fighting eqp w/trk, set No. 21, Army acft crash	1		1															
16	Grader, road, diesel driven, 4 x 4	3																	
17	Truck, ambulance, ¾-ton, 4 x 4	39	1																
18	Truck, ambulance, frontline, ¼-ton, 4 x 4	61	1								(5)	5		(4)	4		(5)	5	
19	Truck, cargo, ¾-ton, 4 x 4	276	4	19	5	6	(42)	9	17	16	(3)	3		(2)	2		(11)	11	
20	Truck, cargo, ¾-ton, 4 x 4, w/winch	49		4			(18)	4	5	9	(2)	2		(2)	2				
21	Truck, cargo, 2½-ton, 6 x 6, LWB	341	5	1	1	3	(25)	15	10		(7)	3	1	(8)	4	1	(10)	6	1
22	Truck, cargo, 2½-ton, 6 x 6, LWB, w/winch	166	1		2	1	(22)	5	10	7	(10)	6	1	(9)	5	1	(8)	4	1
23	Truck, cargo, 5-ton, 6 x 6, LWB	189									(13)	18		(9)	9		(12)	12	
24	Truck, cargo, 5-ton, 6 x 6, LWB, w/winch	60									(4)	4		(4)	4		(4)	4	
25	Truck, cargo, 5-ton, 6 x 6, SWB, w/winch	22																	
26	Truck, cargo, 5-ton, 6 x 6, XLWB	4																	

	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48
	Engr bn				Div arty												Div tn												
	Total bn	HQ & HQ co	4 engr co (ea)	Brig co	Total div arty	HQ & HQ btry	3 FA how bn, 105-mm, SP (ea)				FA comp bn				Svc btry	HQ & HQ det & band	Admin co	QM bn				Ord bn			Med bn				
							Total bn	HQ & HQ btry	3 FA how btry, 105-mm (ea)	Svc btry	Total bn	HQ & HQ btry	2 FA how btry, 155-mm, SP (ea)	FA how btry, 8-in, SP				FA msl btry, 762-mm rkt, SP	Total bn	HQ & HQ det	Sup co	Fld svc co	Total bn	HQ & main spt co	3 fwd spt co (ea)	Total bn	HQ & HQ det	Amb co	Cir co
1																													
2																													
3																													
4																													
5																													
6																													
7	(43)	3	10		(53)	3	(13)	7	2		(11)	4	2	3									(9)		3				
8					(54)		(18)		6																				
9					(12)						(12)		6																
10					(4)						(4)			4															
11	(2)	2			(8)		(2)			2	(2)					2							(4)	1	1				
12																													
13	(12)		3																										
14	(3)	3																											
15																													
16	(3)	3																											
17					(5)	1	(1)	1			(1)	1							(1)	1						(32)		32	
18	(3)	3																								(16)		16	
19	(5)	4			(117)	15	(23)	10	4	1	(33)	9	4	5	10	1	2	2	(13)	2	1	10	(10)	7	1	(8)	3		5
20					(10)		(2)	2			(4)	4							(1)	1									
21	(27)	13	1	10	(64)	3	(14)	4	2	4	(19)	4	2	2	5	4	3	5	(53)		47	6	(57)	15	14	(21)	6		15
22	(5)		1	1	(18)	7	(3)	1		2	(2)					2	2	2	(8)		7	1	(14)	2	4	(7)	2	1	4
23	(3)	3			(24)		(2)			2	(18)		6	4		2			(42)			42							
24					(18)		(6)			6									(6)			6							
25					(22)		(6)		2		(4)					4													
26					(4)						(4)				4														

1		2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
Item		Total armd div	Div trp								4 armor bn, 90-mm (ea)			4 armd inf bn (ea)			Cav sq		
			HQ & HQ co	Avn co	MP co	3 HQ & HQ co, CC (ea)	Sig bn				Total bn (ea)	HQ & HQ co	4 med tk co, 90-mm (ea)	Total bn (ea)	HQ & HQ co	4 rifle co (ea)	Total sq	HQ & HQ trp	4 recon trp (ea)
							Total	HQ & HQ co	Comd op co	Fwd comm co									
WHEELED VEHICLES— Continued																			
27	Truck, dump, 2½-ton, 6 x 6, LWB	17																	
28	Truck, dump, 2½-ton, 6 x 6, LWB, w/winch	20																	
29	Truck, tank, gasoline, 2½-ton, 6 x 6, LWB, (1,200 gal)	77	4			(1)	1				(8)	8		(4)	4		(8)	8	
30	Truck, wrecker, medium, 5-ton, 6 x 6	3																	
31	Truck, wrecker, medium, 5-ton, 6 x 6, w/winch	47				(1)	1				(3)	3		(2)	2		(2)	2	
32	Truck, van, shop, 2½-ton, 6 x 6	41	7	3															
33	Truck, tractor, 2½-ton, 6 x 6, LWB, w/winch	1																	
34	Truck, tractor, 2½-ton, 6 x 6, SWB	8																	
35	Truck, tractor, 5-ton, 6 x 6, SWB	20																	
36	Truck, tractor, 5-ton, 6 x 6, SWB, w/winch	7																	
37	Truck, tractor, 12-ton, 6 x 6	6																	
38	Truck, tractor, wrecker, 5-ton, 6 x 6, XLWB, w/winch	1	1																
39	Truck, utility, ¼-ton, 4 x 4	865	21	8	44	18	(21)	8	7	6	(44)	32	3	(49)	33	4	(102)	14	22
40	Truck, cargo, treadway 6-ton, 6 x 6, w/winch, w/hydraulic crane	36																	
41	Sig Corps repair shop, trk, mtd, 2½-ton, 6 x 6	8				(8)	5		3										
TRAILERS																			
42	Semitrailer, 45-ton, 8-wheel, transporter	6																	
43	Semitrailer, cargo, 12-ton, 4-wheel	2																	
44	Semitrailer, van, 6-ton, 2-wheel	9	1																
45	Semitrailer, tank, gasoline, 12-ton, 4-wheel, (5,000 gal)	18																	
46	Semitrailer, low bed, 25-ton, 4-wheel	7																	
47	Trailer, 762-mm, rocket	4																	
48	Trailer, ammo, 2-ton, 2-wheel	59																	
49	Trailer, ¼-ton, 2-wheel	411	18	8	20	10	(20)	7	7	6	(13)	9	1	(22)	10	3	(19)		4
50	Trailer, ¾-ton, 2-wheel	244	3	23	1	6	(42)	10	16	16				(1)	1		(8)	8	

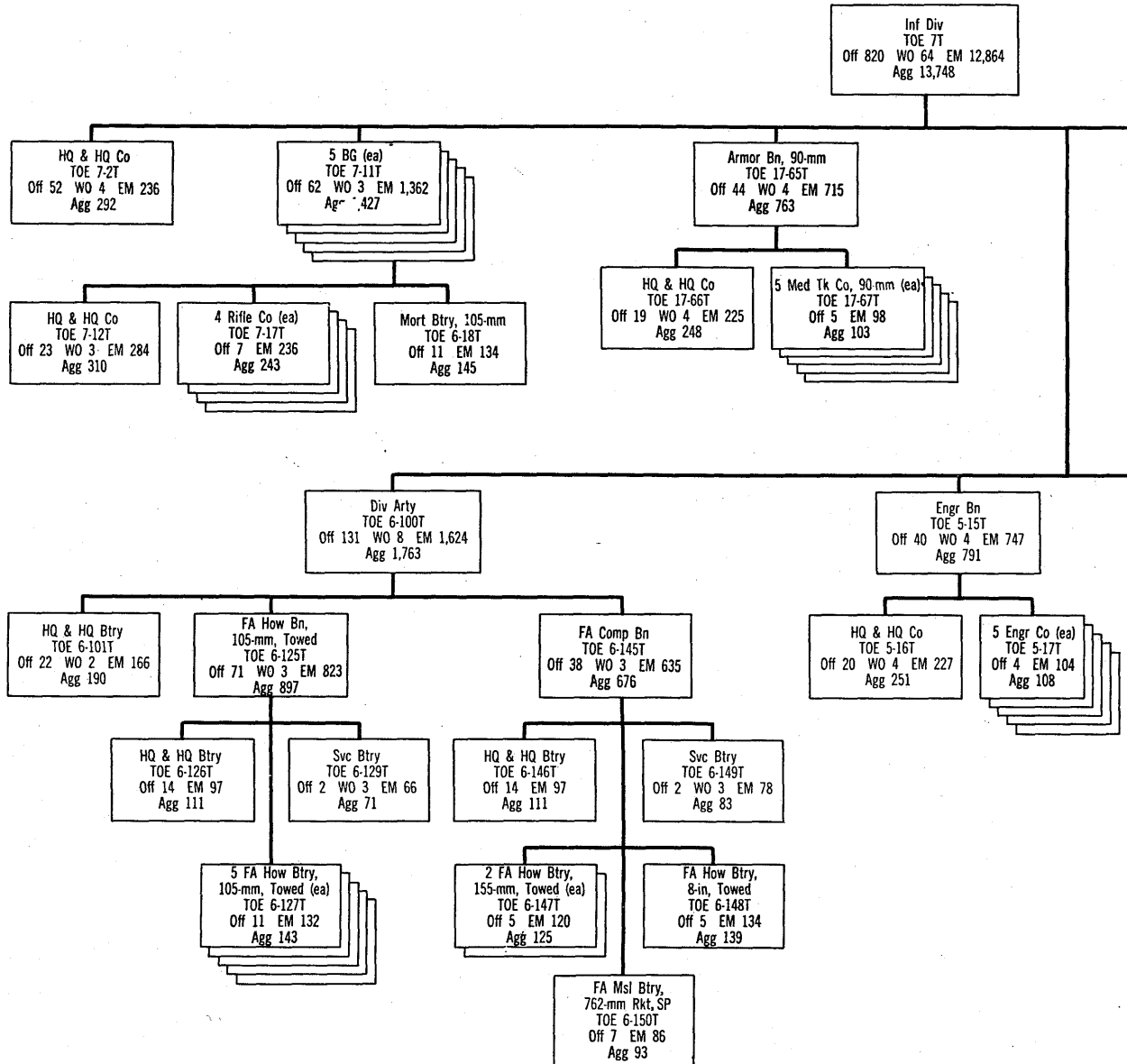
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	Engr bn				Div arty												Div tn												
	Total bn	HQ & HQ co	4 engr co (ea)	Brg co	Total div arty	HQ & HQ btry	3 FA how bn, 105-mm, SP (ea)				FA comp bn				Svc btry	HQ & HQ det & band	Admin co	QM bn				Ord bn			Med bn				
							Total bn	HQ & HQ btry	3 FA how btry, 105-mm (ea)	Svc btry	Total bn	HQ & HQ btry	2 FA how btry, 155-mm, SP (ea)	FA how btry, 8-in, SP				FA msl btry, 762-mm rkt, SP	Total bn	HQ & HQ det	Sup co	Fld svc co	Total bn	HQ & main spt co	3 fwd spt co (ea)	Total bn	HQ & HQ det	Amb co	Cir co
27	(17)	5	3																										
28	(20)	4	4																										
29	(3)	3			(8)		(2)			2	(2)					2			(5)		5								
30	(2)	1		1															(1)		1								
31	(4)		1		(6)		(1)			1	(3)				2	1			(1)			1	(13)	4	3				
32					(12)	4	(2)	2			(2)	1			1								(19)	7	4				
33	(1)	1																											
34																							(8)	8					
35																			(18)		18		(2)	2					
36	(7)	3	1																										
37																							(6)	6					
38																													
39	(33)	13	4	4	(152)	16	(37)	16	6	3	(25)	8	3	4	4	3	4	5	(15)	5	5	5	(21)	9	4	(13)	7	5	1
40	(36)			36																									
41																													
42																							(6)	6					
43																							(2)	2					
44																							(8)	8					
45																			(18)		18								
46	(7)	3	1																										
47					(4)						(4)				4														
48	(3)	3			(56)		(12)		2	6	(20)		6	4		4													
49	(29)	9	4	4	(79)	6	(20)	4	5	1	(13)	2	2	2	3	2	4	4	(8)	4	2	2	(18)	9	3	(13)	7	5	1
50	(4)	3		1	(107)	11	(23)	10	4	1	(27)	9	4	4	5	1	2	2	(13)	2	1	10	(9)	6	1	(8)	3		5

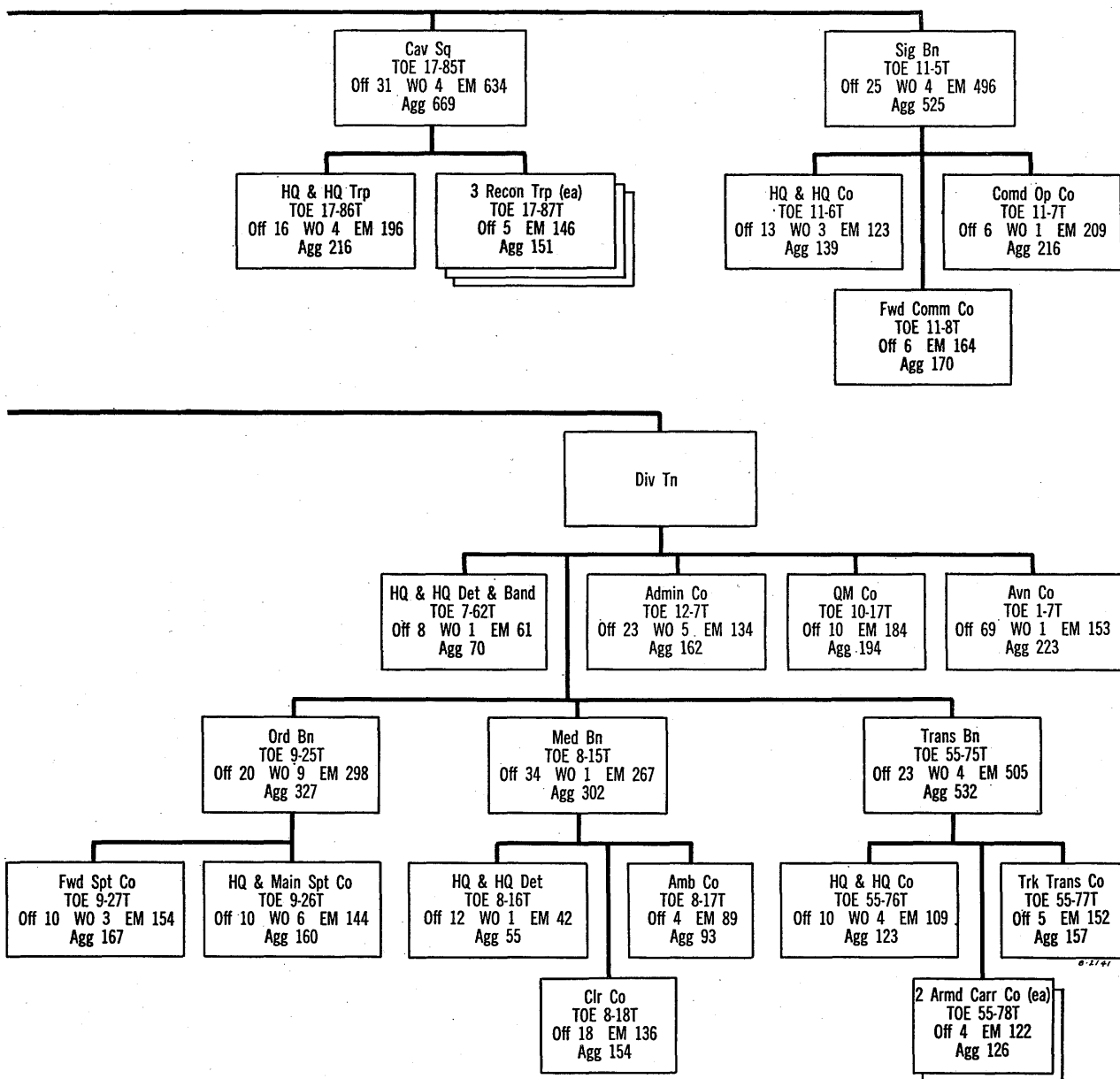
1		2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
Item		Total armd div	Div trp								4 armor bn, 90-mm (ea)			4 armd inf bn (ea)			Cav sq		
			HQ & HQ co	Avn co	MP co	3 HQ & HQ co, CC (ea)	Sig bn				Total bn (ea)	HQ & HQ co	4 med tk co, 90-mm (ea)	Total bn (ea)	HQ & HQ co	4 rifle co (ea)	Total sq	HQ & HQ trp	4 recon trp (ea)
							Total bn	HQ & HQ co	Comd op co	Fwd comm co									
TRAILERS—Continued																			
51	Trailer, cargo, 1½-ton, 2-wheel	662	9	2	1	5	(17)	10	4	3	(34)	26	2	(29)	21	2	(32)	24	2
52	Trailer, tank, water, 1½-ton, 2-wheel	108	1	1	1	1	(3)	1	1	1	(6)	2	1	(6)	2	1	(6)	2	1
53	Trailer, 2-wheel, d, utility pole type	21																	
54	Trailer, 4-wheel, special, 10-ton, flat bed	1																	
VEHICULAR EQUIPMENT																			
55	Angledozer, 17,100–24,000 lb, DBP, tractor	7																	
56	Bulldozer, tank-mounting, medium	28									(4)		1						
57	Boat, assault, plastic, 16 ft	27																	
58	Boat, bridge erection, 2 sec, 27 ft	6																	
59	Boat, reconnaissance, pneumatic	3																	
60	Searchlight, 18-in., 1,000–2,000 W, tank mounting	124									(24)		6				(16)		4
61	Tractor, full-tracked, low, diesel driven, 17,100–24,000 DBP	7																	
62	Total trailers	1,552	31	35	23	22	(82)	28	28	26	(53)	37	4	(58)	34	6	(65)	37	7
63	Total sp vehicles (less acft and veh eqp)	3,445	44	41	52	36	(141)	48	52	41	(203)	103	25	(180)	84	24	(260)	80	45
64	Total aircraft	50		50															
65	Total veh eqp	202									(28)		7				(16)		4

	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	
	Engr bn				Div arty												Div tn													
	Total bn	HQ & HQ co	4 engr co (ea)	Brg co	Total div arty	HQ & HQ btry	3 FA how bn, 105-mm, SP (ea)				FA comp bn						HQ & HQ det & band	Admin co	QM bn				Ord bn			Med bn				
							Total bn	HQ & HQ btry	3 FA how btry, 105-mm (ea)	Svc btry	Total bn	HQ & HQ btry	2 FA how btry, 155-mm SP (ea)	FA how btry, 8-in, SP	FA msl btry, 762-mm rkt, SP	Svc btry			Total bn	HQ & HQ det	Sup co	Fld svc co	Total bn	HQ & main spt co	3 fwd spt co (ea)	Total bn	HQ & HQ det	Amb co	Cir co	
51	(73)	20	13	1	(47)	7	(10)	4	---	6	(10)	3	---	---	1	6	2	3	(103)	---	53	50	(84)	21	21	(22)	6	1	15	
52	(6)	1	1	1	(23)	2	(5)	1	1	1	(6)	1	1	1	1	1	1	4	(2)	---	1	1	(4)	1	1	(5)	1	---	4	
53	(21)	---	---	21	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	
54	(1)	1	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	
55	(7)	3	1	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	
56	(12)	---	3	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	
57	(27)	---	---	27	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	
58	(6)	---	---	6	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	
59	(3)	3	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	
60	(12)	---	3	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	
61	(7)	3	1	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	
62	(144)	40	19	28	(316)	26	(70)	19	12	15	(80)	15	13	11	14	14	9	14	(144)	6	75	63	(131)	53	26	(48)	17	6	25	
63	(229)	64	28	53	(591)	49	(132)	43	22	23	(146)	31	23	22	26	21	9	14	(164)	9	84	71	(163)	61	34	(97)	18	54	25	
64	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
65	(74)	9	8	33	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	

Section V. INFANTRY DIVISION

1.15. Infantry Division (ROCID)—Organization





1.16. Infantry Division—Weapons (TOE 7T)

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Weapons		Total inf div	HQ & HQ co	5 BG (ea)				Armor bn, 90-mm			Cav sq			Engr bn			Sig bn			
				Total BG	HQ & HQ co	4 rifle co (ea)	Mort btry, 105-mm	Total bn	HQ & HQ co	5 med tk co, 90-mm (ea)	Total sq	HQ & HQ trp	3 recon trp (ea)	Total bn	HQ & HQ co	5 engr co (ea)	Total bn	HQ & HQ co	Comd op co	Fwd comm co
1	Carbine, cal .30, M2-----	3,193	111	(155)	72	7	55	(78)	73	1	(113)	101	4	(56)	36	4	(209)	65	100	44
2	Gun, machine, cal .30, M1919A4-----	228	---	(11)	5	---	6	(13)	13	---	(47)	2	15	(30)	---	6	(5)	---	---	5
3	Gun, machine, cal .30, M1919A6-----	200	8	(34)	2	8	---	---	---	---	---	---	---	(2)	2	---	---	---	---	---
4	Gun, machine, cal .50, M2-----	158	---	(6)	6	---	---	(16)	16	---	(15)	15	---	(25)	10	3	(12)	3	4	5
5	Gun, submachine, cal .45, M3A1-----	584	18	(4)	4	---	---	(270)	75	39	(109)	49	20	(25)	25	---	(108)	20	47	41
6	Gun, tank, 76-mm-----	33	---	(2)	2	---	---	---	---	---	(23)	2	7	---	---	---	---	---	---	---
7	Gun, tank, 90-mm-----	92	---	---	---	---	---	(89)	4	17	---	---	---	(3)	3	---	---	---	---	---
8	Gun, 90-mm, SP, full-tracked, M56-----	20	---	(4)	4	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
9	Howitzer, 105-mm, on carriage-----	30	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
10	Howitzer, 155-mm, on carriage-----	12	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
11	Howitzer, 8-in., on carriage-----	4	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
12	Launcher, 762-mm rkt, trk-mtd-----	2	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
13	Launcher, rkt, 3.5-in.-----	569	11	(64)	10	12	6	(37)	22	3	(21)	3	6	(39)	9	6	(19)	3	6	10
14	Mortar, 81-mm, on mount-----	74	---	(13)	1	3	---	---	---	---	(9)	---	3	---	---	---	---	---	---	---
15	Mortar, 4.2-in., on mount-----	40	---	(8)	---	---	8	---	---	---	---	---	---	---	---	---	---	---	---	---
16	Pistol, auto, cal .45, M1911A1-----	1,848	55	(194)	25	42	1	(457)	47	82	(185)	56	43	(19)	19	---	(9)	9	---	---
17	Rifle, auto, cal .30, M1918A2-----	656	5	(110)	2	24	12	---	---	---	(18)	---	6	---	---	---	---	---	---	---
18	Rifle, US, cal .30, M1-----	7,480	101	(918)	209	158	77	(150)	65	17	(298)	16	94	(690)	170	104	(199)	45	69	85
19	Rifle, US, cal .30, M1C (snipers)-----	240	---	(48)	---	12	---	---	---	---	---	---	---	---	---	---	---	---	---	---
20	Rifle, 106-mm, on mount-----	40	---	(8)	---	2	---	---	---	---	---	---	---	---	---	---	---	---	---	---
21	Individual weapons-----	14,001	290	(1,429)	312	243	145	(955)	260	139	(723)	222	167	(790)	250	108	(525)	139	216	170
22	Crew-served weapons-----	1,502	19	(150)	30	25	20	(155)	55	20	(115)	22	31	(99)	24	15	(36)	6	10	20
23	Total weapons-----	15,503	309	(1,579)	342	268	165	(1,110)	315	159	(838)	244	198	(889)	274	123	(561)	145	226	190

	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47
	Div arty												Div tn														
Total div arty	HQ & HQ btry	FA how bn, 105-mm, towed				FA comp bn					HQ & HQ det & band	QM co	Med bn				Ord bn			Avn co	Admin co	Trans bn					
		Total bn	HQ & HQ btry	5 FA how btry, 105-mm, towed (ea)	Svc btry	Total bn	HQ & HQ btry	2 FA how btry, 155-mm, towed (ea)	FA how btry, 8-in, towed	FA msl btry, 762-mm rkt, SP			Svc btry	Total bn	HQ & HQ det	Amb co	Clr co	Total bn	HQ & main spt co			Fwd spt co	Total bn	HQ & HQ co	Trk trans co	2 armd carr co (ea)	
1	(702)	96	(340)	60	51	25	(266)	60	45	60	32	24	53	142	(254)	43	84	127	(190)	96	94	83	123	(304)	64	102	69
2	(63)	1	(36)	3	6	3	(26)	3	6	5	4	2							(11)		11	4					
3																							4	(16)		16	
4	(38)	5	(18)	1	2	7	(15)	1	4			6		5					(14)	5	9	2	1				
5	(1)						(1)					1	5	2					(23)	9	14		3				
6																											
7																											
8																											
9	(30)		(30)		6																						
10	(12)						(12)		6																		
11	(4)						(4)			4																	
12	(2)						(2)				2																
13	(100)	8	(54)	6	8	8	(38)	6	5	7	8	7		2					(6)	3	3	4	2	(8)	2	2	2
14																											
15																											
16	(36)	13	(11)	5	1	1	(12)	5	1	1	1	3	3	2	(21)	8		13	(8)	5	3	69	11	(3)	3		
17	(83)	4	(42)	4	7	3	(37)	4	9	8	4	3															
18	(941)	75	(504)	42	84	42	(362)	42	70	70	56	54	7	48	(27)	4	9	14	(108)	50	58	71	25	(225)	56	55	57
19																											
20																											
21	(1,763)	188	(897)	111	143	71	(678)	111	125	139	93	85	68	194	(302)	55	93	154	(329)	160	169	223	162	(532)	123	157	126
22	(249)	14	(138)	10	22	18	(97)	10	21	16	14	15		7					(31)	8	23	10	7	(24)	2	18	2
23	(2,012)	202	(1,035)	121	165	89	(775)	121	146	155	107	100	68	201	(302)	55	93	154	(360)	168	192	233	169	(556)	125	175	128

1.17. Infantry Division—Vehicles (TOE 7T)

1		2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Item		Total inf div	HQ & HQ co	5 BG (ea)				Armor bn, 90-mm			Cav sq			Engr bn			Sig bn			
				Total BG	HQ & HQ co	4 rifle co (ea)	Mort btry, 105-mm	Total bn	HQ & HQ co	5 med tk co, 90-mm (ea)	Total sq	HQ & HQ trp	3 recon trp (ea)	Total bn	HQ & HQ co	5 engr co (ea)	Total bn	HQ & HQ co	Comd op co	Fwd comm co
AIRCRAFT																				
1	Airplane, observation	16																		
2	Airplane, utility	6																		
3	Helicopter, recon	20																		
4	Helicopter, utility	8																		
TRACKED VEHICLES																				
5	Carrier, pers, full tracked	181		(2)	2			(18)	8	2	(32)	8	8							
6	Gun, 90-mm, SP, full track	20		(4)	4															
7	Tank recovery veh, medium	15						(7)	2	1	(4)	1	1							
8	Tank, combat, FT, 76-mm gun	33		(2)	2						(23)	2	7							
9	Tank, combat, FT, 90-mm gun	92						(89)	4	17				(3)	3					
10	Tractor, low speed diesel	14												(14)	4	2				
WHEELED VEHICLES																				
11	Compressor, air, set No. 4, trk mtd	11												(11)	1	2				
12	Crane, shovel, trk mtd, 10-ton	1																		
13	Crane, shovel, trk mtd, 20-ton	4												(4)	4					
14	Fire fighting eqp w/trk, set No. 21, Army acft crash	1																		
15	Grader, road, diesel, 4 x 4	4												(4)	4					
16	Shop eqp, contact maint, trk mtd, set No. 3	1												(1)	1					
17	Tool and bench shop eqp, trk mtd	1												(1)	1					
18	Tractor, FT, high speed, medium	5																		
19	Tractor, FT, high speed, light	12																		
20	Launcher, 762-mm, 5-ton, trk mtd	2																		
21	Loader, bucket, rubber tired, 1½ yd	3												(3)	3					
22	Truck, ambulance, front line, ¼-ton, 4 x 4	32	2	(4)	4			(6)	6		(4)	4								
23	Truck, ambulance, ¾-ton, 4 x 4	40												(1)	1					
24	Truck, cargo, ¾-ton, 4 x 4	484	6	(44)	9	4	19	(4)	4		(10)	10		(9)	4	1	(53)	7	20	26

	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47
	Div arty													Div tn													
	Total div arty	HQ & HQ btry	FA how bn, 105-mm, towed				FA comp bn				HQ & HQ det & band	QM co	Med bn				Ord bn				Avn co	Admin co	Trans bn				
			Total bn	HQ & HQ btry	5 FA how btry 105-mm, towed (ea)	Svc btry	Total bn	HQ & HQ btry	2 FA how btry, 155-mm, towed (ea)	FA how btry, 8-in, towed			FA msl btry, 762-mm rkt, SP	Svc btry	Total bn	HQ & HQ det	Amb co	Clr co	Total bn	HQ & main spt co			Fwd spt co	Total bn	HQ & HQ co	Trk trans co	2 armd carr co (ea)
1																						16					
2																						6					
3																						20					
4																						8					
5																			(6)	6			(115)	1		57	
6																											
7	(1)										1								(1)	1			(2)	2			
8																											
9																											
10																											
11																											
12																			(1)	1							
13																											
14																					1						
15																											
16																											
17																											
18	(5)						(5)			4	1																
19	(12)						(12)			6																	
20	(2)						(2)				2																
21																											
22																											
23	(3)	1	(1)	1			(1)	1							(36)		36										
24	(117)	16	(62)	10	10	2	(39)	10	6	6	9	2	3	15	(6)	3	3	(18)	2	16	18	2	(3)	3			

1		2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Item		Total inf div	HQ & HQ co	5 BG (ea)				Armor bn, 90-mm			Cav sq			Engr bn			Sig bn			
				Total BG	HQ & HQ co	4 rifle co (ea)	Mort btry, 105-mm	Total bn	HQ & HQ co	5 med tk co, 90-mm (ea)	Total sq	HQ & HQ trp	3 recon trp (ea)	Total bn	HQ & HQ co	5 engr co (ea)	Total bn	HQ & HQ co	Comd op co	Fwd comm co
WHEEL VEHICLES— Continued																				
25	Truck, cargo, ¾-ton, 4 x 4, w/winch	38						(1)	1		(3)		1				(22)	1	6	15
26	Truck, cargo, 2½-ton, 6 x 6, LWB	228	2	(6)	5		1	(6)	6		(7)	7		(19)	14	1	(19)	8	11	
27	Truck, cargo, 2½-ton, 6 x 6, LWB w/winch	115		(10)	10			(6)	6		(4)	4		(5)	5		(25)	9	11	5
28	Truck, cargo, 2½-ton, 6 x 6, SWB w/winch	30																		
29	Truck, cargo, 5-ton, 6 x 6, LWB	35		(2)	2			(15)	15		(6)	6								
30	Truck, cargo, 5-ton, 6 x 6, LWB w/winch	21		(2)	2			(4)	4		(2)	2								
31	Truck, cargo, 5-ton, 6 x 6, SWB w/winch	24																		
32	Truck, cargo, 5-ton, 6 x 6, XLWB	4																		
33	Truck, dump, 2½-ton, 6 x 6	4												(4)	4					
34	Truck, dump, 2½-ton, 6 x 6, LWB w/winch	43												(43)	3	8				
35	Truck, tank, gasoline, 2½-ton, 6 x 6	28																		
36	Truck, wrecker, lt, 2½-ton, 6 x 6, w/winch	5		(1)	1															
37	Truck, wrecker, med, 5-ton, 6 x 6	1																		
38	Truck, wrecker, med, 5-ton, 6 x 6, w/winch	25						(3)	3		(2)	2		(1)	1		(1)	1		
39	Truck, van, shop, 2½-ton, 6 x 6	28		(1)	1															
40	Truck, shop, Sig Corps, repair, mtd, 2½-ton, 6 x 6	9															(9)	4		5
41	Truck, tractor, 2½-ton, 6 x 6, LWB w/winch	1												(1)	1					
42	Truck, tractor, 2½-ton, 6 x 6, SWB	8																		
43	Truck, tractor, 5-ton, 6 x 6, SWB	15												(10)		2				
44	Truck, tractor, 5-ton, 6 x 6, SWB w/winch	4												(4)	4					
45	Truck, tractor, 12-ton, 6 x 6	2																		
46	Truck, tractor wrecker, 5-ton, 6 x 6, XLWB w/winch	1																		
47	Truck, utility, ¼-ton, 4 x 4	601	43	(52)	29	4	7	(34)	24	2	(63)	9	18	(24)	9	3	(16)	7	9	
48	Truck, cargo treadway, 6-ton, 6 x 6, w/crane	3												(3)	3					

	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47
	Div arty												Div tn														
Total div arty	HQ & HQ btry	FA how bn, 105-mm, towed				FA comp bn				HQ & HQ det & band	QM co	Med bn				Ord bn			Avn co	Admin co	Trans bn						
		Total bn	HQ & HQ btry	5 FA how btry, 105-mm, towed (ea)	Svc btry	Total bn	HQ & HQ btry	2 FA how btry, 155-mm, towed (ea)	FA how btry, 8-in, towed			FA msl btry, 762-mm rkt, SP	Svc btry	Total bn	HQ & HQ det	Amb co	Clr co	Total bn			HQ & main spt co	Fwd spt co	Total bn	HQ & HQ co	Trk trans co	2 armd carr co (ea)	
25	(8)		(4)	4			(4)	4														4					
26	(34)	4	(15)	2	1	8	(15)	2	1	1	4	6	2	8	(3)			3	(17)	8	9	1	4	(76)	4	72	
27	(8)	5	(1)			1	(2)					2		1	(1)	1			(3)	2	1		1	(11)	3	8	
28	(30)		(30)		6																						
29	(4)						(4)			4																	
30	(5)		(5)			5																					
31	(24)		(10)		2		(14)		3			8															
32	(4)						(4)				4																
33																											
34																											
35														28													
36																											
37																								(1)	1		
38	(4)		(1)			1	(3)				2	1		1					(13)	3	10						
39	(12)	7	(1)	1			(4)	1		2	1								(8)	7	1	3					
40																											
41																											
42																			(8)	8							
43														5													
44																											
45																			(2)	2							
46																						1					
47	(92)	16	(51)	9	8	2	(25)	9	3	3	5	2	5	3	(11)	6	4	1	(21)	11	10	8	5	(16)	9	5	1
48																											

		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Item		Total inf div	HQ & HQ co	5 BG (ea)				Armor bn, 90-mm			Cav sq		Engr bn			Sig bn					
				Total BG	HQ & HQ co	4 rifle co (ea)	Mort btry, 105-mm	Total bn	HQ & HQ co	5 med tk co, 90-mm (ea)	Total sq	HQ & HQ trp	3 recon trp (ea)	Total bn	HQ & HQ co	5 engr co (ea)	Total bn	HQ & HQ co	Comd op co	Fwd comm co	
TRAILERS																					
49	Compressor, air, trailer mtd, 2-wheel, 55 CFM	1																			
50	Semitrailer, tank transporter, 45-ton, 8-wheel	2																			
51	Semitrailer, stake, cargo, 6-ton, 2-wheel	9																			
52	Semitrailer, tank, gasoline, 12-ton, 4-wheel	5																			
53	Semitrailer, low bed, 25-ton, 4-wheel	14													(14)	4	2				
54	Trailer, 762-mm rkt	4																			
55	Trailer, ammo, 2-ton, 2-wheel	39		(2)	2																
56	Trailer, amph, cargo, 1/4-ton, 2-wheel	403	31	(38)	24	2	6	(12)	7	1	(8)	2	2	(23)	8	3	(16)	7	9		
57	Trailer, cargo, 3/4-ton, 2-wheel	440	6	(41)	9	4	16	(1)	1		(9)	6	1	(7)	2	1	(52)	18	19	26	
58	Trailer, cargo, 1 1/2-ton, 2-wheel	267		(12)	12			(20)	15	1	(19)	16	1	(27)	17	2	(8)	4	4		
59	Trailer, tank, water, 1 1/2-ton, 2-wheel	81	2	(6)	6			(6)	6		(4)	4		(6)	6		(3)	3			
60	Trailer, utility pole, 2 1/2-ton, 2-wheel	36												(36)	6	6					
61	Trailer, flat bed, 10-ton, 4-wheel	4												(4)	4						
62	Weld eqp, trailer mtd	2												(2)	2						
63	Total trailers	1,307	39	(99)	53	6	22	(39)	29	2	(40)	28	4	(119)	49	14	(79)	22	31	26	
64	Total sp veh (less aircraft)	2,229	53	(130)	71	8	27	(193)	83	22	(160)	55	35	(165)	70	19	(145)	27	57	51	
65	Total aircraft	50																			

	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47
	Div arty												Div tn														
	Total div arty	HQ & HQ btry	FA how bn, 105-mm, towed				FA comp bn				HQ & HQ det & band	QM co	Med bn				Ord bn			Avn co	Admin co	Trans bn					
			Total bn	HQ & HQ btry	5 FA how btry, 105-mm, towed (ea)	Svc btry	Total bn	HQ & HQ btry	2 FA how btry, 155-mm, towed (ea)	FA how btry, 8-in, towed			FA msl btry, 762-mm rkt, SP	Svc btry	Total bn	HQ & HQ det	Amb co	Clr co	Total bn			HQ & main spt co	Fwd spt co	Total bn	HQ & HQ co	Trk trans co	2 armed carr co (ea)
49																			(1)	1							
50																			(2)	2							
51																			(8)	8		1					
52													5														
53																											
54	(4)						(4)				4																
55	(29)		(15)		2	5	(14)			3		8															
56	(54)	6	(36)	1	7		(12)	1	2	2	4	1	5	3	(11)	6	4	1	(21)	11	10	8	5	(16)	9	5	1
57	(93)	12	(51)	10	8	1	(30)	10	5	5	4	1	3	15	(6)	3		3	(18)	2	16	22	2	(1)	1		
58	(16)	6	(3)	2		1	(7)	2		2	1	2	1	2					(26)	15	11	2	3	(83)	3	80	
59	(15)	2	(7)			7	(6)					6	1	1	(4)	1		3	(2)	2		1	2	(4)	4		
60																											
61																											
62																											
63	(211)	26	(112)	13	17	14	(73)	13	7	12	13	18	10	26	(21)	10	4	7	(78)	41	37	34	12	(104)	17	85	1
64	(365)	49	(181)	27	27	19	(135)	27	19	20	27	23	10	61	(57)	10	40	7	(98)	44	54	36	12	(224)	23	85	58
65																					50						

Section VI. ENGINEER AMPHIBIOUS SUPPORT COMMAND

1.18. General

a. The engineer amphibious support command is the proposed replacement for the amphibious support brigade type organization. The basic mission will involve, with organic and attached units, combat support to major tactical units in joint or unilateral operations involving the passage of major water barriers to include—

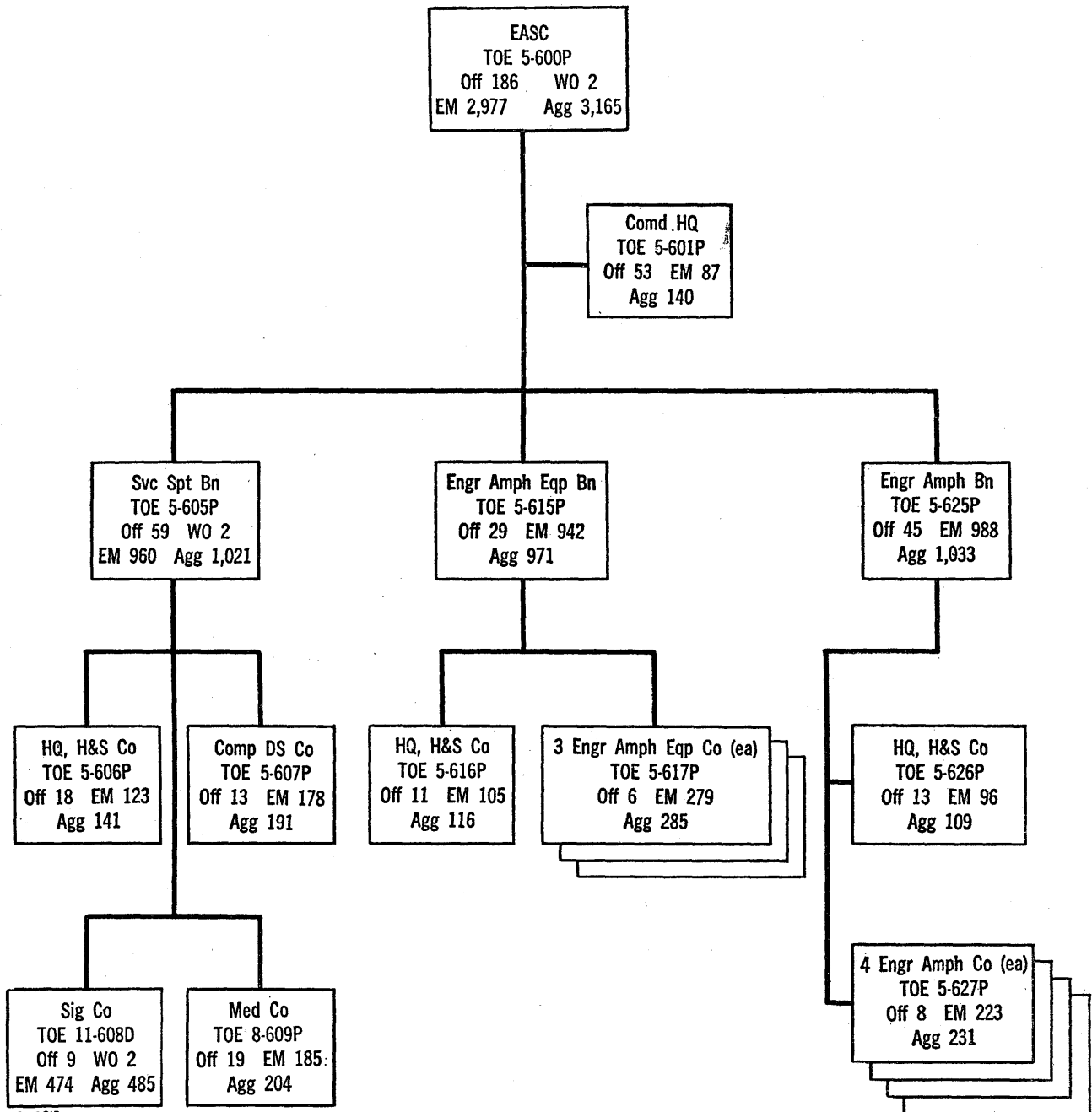
- (1) Landing on a hostile shore.
- (2) Crossing of major rivers and water barriers.

It will provide planning staffs at corps and division level to assist in the preparation of operational plans for these units when engaged in an amphibious landing or the crossing of major rivers or other water barriers. When rein-

forced by the attachment of engineer combat or construction battalions, other support units as required, and naval beach elements, it will provide sufficient balanced shore party teams to support an army landing force consisting of one corps in the assault phase of an amphibious operation. Further, the engineer amphibious support command is capable of providing lift in amphibian vehicles (OVTs) for displacement over water, or short distances over land, for the major portion of the assault elements of one infantry division.

b. The following data are based upon tentative manning charts, 24 July 1957, and represent the best data currently available. The data should be used for preliminary planning estimates only and for instructional purposes at service schools.

1.19. Engineer Amphibious Support Command



8-3813

1.20. Engineer Amphibious Support Command—Weapons

	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	Item	Total engr amph spt comd	HQ, engr amph spt comd	Svc spt bn				Engr amph eqp bn			Engr amph bn			
				Total bn	HQ, H&S co	Comp DS co	Sig co	Med co	Total bn	HQ, H&S co, eqp bn	3 engr amph eqp co (ea)	Total bn	HQ, H&S co	4 engr amph co (ea)
2	Carbine, cal .30-----	871	97	(470)	108	83	80	199	(170)	62	36	(134)	26	27
3	Gun, submachine, cal .45, M3-----	212	-----	(54)	12	42	-----	-----	(81)	15	22	(77)	9	17
4	Gun, machine, cal .50-----	42	-----	(19)	4	11	4	-----	(7)	4	1	(16)	-----	4
5	Gun, machine, cal .30-----	52	-----	(4)	-----	2	2	-----	-----	-----	-----	(48)	-----	12
6	Gun, tank, med, 90-mm, w/ bulldozer-----	24	-----	-----	-----	-----	-----	-----	-----	-----	-----	(24)	-----	6
7	Launcher, 3.5-in. rkt-----	70	-----	(9)	4	4	1	-----	(26)	5	7	(35)	3	8
8	Pistol, auto, cal .45, M1911A1-----	901	40	(15)	8	-----	2	5	(707)	26	227	(139)	3	34
9	Rifle, US, cal .30-----	1,099	-----	(403)	13	66	324	-----	(13)	13	-----	(683)	71	153
10	Rifle, 106-mm, M40-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
11	Individual weapons-----	3,083	137	(942)	141	191	406	204	(971)	116	285	(1,033)	109	231
12	Crew-served weapons-----	188	-----	(32)	8	17	7	-----	(33)	9	8	(123)	3	30
13	Total weapons-----	3,271	137	(974)	149	208	413	204	(1,004)	125	293	(1,156)	112	255

1.21. Engineer Amphibious Support Command—Vehicles and Major Equipment

	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	Item	Total engr amph spt comd	HQ engr amph spt comd	Svc spt bn					Engr amph eqp bn			Engr amph bn		
				Total bn	HQ, H&S co	Comp DS co	Sig co	Med co	Total bn	HQ, H&S co	3 engr amph eqp co (ea)	Total bn	HQ, H&S co	4 engr amph co (ea)
	AIRCRAFT													
2	Airplane, observation.....	1		(1)	1									
3	Helicopter, recon.....	4		(4)	4									
4	Total aircraft.....	5		(5)	5									
	TRACKED VEHICLES													
5	Tank, med, 90-mm gun, w/bulldozer.....	24										(24)		6
6	Tractor, full-tracked, low speed, diesel, 24,100-32,000 DBP, w/bulldozer, tilt, cable.....	15		(3)	3							(12)		3
7	Landing vehicle, tracked.....	206							(206)	11	65			
8	Total tracked vehicles.....	245		(3)	3				(206)	11	65	(36)		9

	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	Item	Total engr amph spt comd	HQ engr amph spt comd	Svc spt bn					Engr amph eqp bn			Engr amph bn		
				Total bn	HQ, H&S co	Comp DS co	Sig co	Med co	Total bn	HQ, H&S co	3 engr amph eqp co (ea)	Total bn	HQ, H&S co	4 engr amph co (ea)
	WHEELED VEHICLES													
9	Auto, sedan, light.....	1		(1)	1									
10	Compressor, air, truck mtd, gas driven, 210 cfm, mtd on ord M45 chassis.....	13										(13)	1	3
11	Truck, utility, 1/4-ton, 4 x 4.....	192	3	(85)	22	15	46	2	(13)	10	1	(91)	11	20
12	Truck, 1/4-ton, frontline amb.....	12		(12)				12						
13	Truck, 3/4-ton, ambulance.....	12		(12)				12						
14	Truck, 3/4-ton, cargo.....	102	1	(84)	4	6	73	1	(5)	2	1	(12)	8	1
15	Truck, 3/4-ton, emerg rep.....	1							(1)					
16	Truck, 2 1/2-ton, amph.....													
17	Truck, 2 1/2-ton, 6 x 6, cargo.....	111		(63)	17	17	12	17	(22)	10	4	(26)	6	5
18	Truck, 2 1/2-ton, emerg rep.....													
19	Truck, 2 1/2-ton, 6 x 6, w/winch, M109, shop, van.....	4		(4)	1	3								
20	Truck, 5-ton, dump.....													
21	Truck, 5-ton, 6 x 6, prime mover.....													
22	Truck, 5-ton, 6 x 6, med wrecker.....	5		(3)	1	2			(1)	1		(1)	1	
23	Truck, 10-ton, tractor.....													
24	Truck, 10-ton, 6 x 6, prime mover, w/winch.....													
25	Truck, tank, gasoline, 2 1/2-ton, 6 x 6, w/winch.....	1		(1)	1									
26	Truck, dump, 5-ton, 6 x 6.....	60		(10)		10						(50)	2	12
27	Truck, tractor, 5-ton, 6 x 6, SWB, w/winch.....	17		(4)		4						(13)	1	3
28	Truck, tractor, 10-ton, 6 x 6, w/winch.....	8		(8)		8								
29	Landing vehicle, wheeled, 2 1/2-ton, 6 x 6.....	24										(24)		6
30	Total wheeled vehicles.....	563	4	(287)	47	65	131	44	(42)	23	6	(230)	30	50
	TRAILERS													
31	Compressor, air, tlr mtd, 4-wheel, diesel driven, 500 cfm.....													
32	Semitrailer, 25-ton, low bed, rear load- ing, w/o dolly.....	8		(8)		8								
33	Trailer, 1/4-ton, cargo, 2-wheel.....	133	3	(83)	22	13	46	2	(101)	7	1	(37)	9	7
34	Trailer, 3/4-ton, cargo, 2-wheel.....	98	1	(87)	4	12	71		(4)	1	1	(6)	6	
35	Trailer, 1-ton, cargo, 2-wheel.....	8		(8)			8							
36	Trailer, 1 1/2-ton, cargo, 2-wheel.....	78		(46)	12	8	10	16	(12)	6	2	(20)	4	4
37	Trailer, 1 1/2-ton, water, 2-wheel.....	16		(7)	2	2	2	1	(4)	1	1	(5)	1	1
38	Trailer, 2 1/2-ton, 2-wheel, pole type, inf raft or pneumatic brg eqp.....													
39	Trailer, 10-ton, 4-wheel tandem.....													
40	Trailer, woodworking.....													
41	Semitrailer, cargo, van, 6-ton, 2-wheel.....	2		(2)		2								
42	Semitrailer, low bed, 25-ton, 4-wheel.....	13										(13)	1	3
43	Total trailers.....	356	4	(241)	40	45	137	19	(30)	15	5	(81)	21	15

	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	Item	Total engr amph spt comd	HQ engr amph spt comd	Svc spt bn					Engr amph eqp bn			Engr amph bn		
				Total bn	HQ, H&S co	Comp DS co	Sig co	Med co	Total bn	HQ, H&S co	3 engr amph eqp co (ea)	Total bn	HQ, H&S co	4 engr amph co (ea)
EQUIPMENT														
44	Boat, control and util, diesel, steel, 46-ft, design 4003	4							(4)	1	1			
45	Carpenter's amph trailer, M1, Eng sq													
46	Crane, nonrevolving, tractor op, wheeled, pneumatic tired, 20-ton													
47	Crane, shovel, crawler, 10-ton, at 12-ft radius, ¾ yd, gas driven	13										(13)	1	3
	Boom 35-ft	13										(13)	1	3
	Boom, extension, 10-ft	13										(13)	1	3
48	Crane, revolving, tractor mtd, 750-lb cap													
49	Clean unit, steam, wheel mtd, oil burning	2		(2)		2								
50	Dolly, 4-wheel tandem, dual-tired for 20-ton, low bed semitrailer													
51	Grader, road, towed, 12-ft moldboard													
52	LVTP 5													
53	LCM MK VI													
54	Lift truck, 6,000-lb	1		(1)		1								
55	Power control unit, cable operated, rear mtd, 2-drum, 24,000-32,000 DBP													
56	Shop eqp, motorized, gen purpose repair													
57	Shop eqp, gen purpose, hvy, semitrailer mtd, set No. 1	1		(1)		1								
58	Shop eqp, org rep, lt, trk mtd, set No. 2	1										(1)	1	
59	Shop eqp, emergency rep, trk mtd, set No. 3	6		(5)		5						(1)	1	
60	Shop eqp, electrical rep, semitrailer mtd, set No. 4	1		(1)		1								
61	Weld eqp, set No. 1, electrical arc 300-amp, trailer mtd	6		(1)	1				(4)	1	1	(1)	1	
62	SigC rep shop, trk mtd, 2½-ton, M185	8		(8)			8							
63	SigC trailer, K-22													
64	Tractor, diesel driven, 24,100-32,000-lb DBP													
65	Dolly trailer converter, 18-ton, 4-wheel	8		(8)		8								
66	Crane, tractor, towed, 20-ton, 20-ft max height of lift	2		(2)		2								
67	Power control unit, cable operating, front mounting, 1-drum, 24,100-32,000-lb DBP, tractor	3		(3)		3								
68	Power control unit, cable operating, rear mounting, 1-drum, 24,100-32,000-lb DBP, tractor	3		(3)		3								
69	Crane, tractor, mounting end, 7,500-lb cap, 35-ft long, not folding or telescopic boom for tractor, full-tracked, low speed	1		(1)		1								

	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	Item	Total engr amph spt comd	HQ engr amph spt comd	Svc spt bn					Engr amph eqp bn			Engr amph bn		
				Total bn	HQ, H&S co	Comp DS co	Sig co	Med co	Total bn	HQ, H&S co	3 engr amph eqp co (ea)	Total bn	HQ, H&S co	4 engr amph co (ea)
70	Generator set, diesel engine, skid mtd, ac, 3 ph, 15 kw, 416v line to line, 208v line to neutral, 60 cy, convertible to 12.5 kw, 416v line to line, 200v line to neutral, 50 cy	2	1	(1)		1								
71	Lubricating and servicing unit, power op, tlr mtd, 12 cfm, air compressor, gas engine w/starter generator, operable to minus 65° F., winterized	1		(1)		1								
72	Grader, road, motorized, diesel power unit, 12,500-14,475-lb pressure at blade, 12-ft long blade	12										(12)		3
73	Lubricating servicing unit, power operated, tlr mtd, 9 cfm air compressor, gas engine	4										(4)		1

Section VII. UNITED STATES ARMY MISSILE COMMAND (HEAVY)

1.22. General

a. Introduction. The United States Army missile command (heavy), TOE 39-71T, is organized as a tactical unit to provide field artillery missile atomic fire in general support of ground forces and to reinforce fires of the United States Army missile command (medium). It is composed of the units shown in the organization chart in paragraph 1.23. The United States Army missile command (heavy) may be allocated as required. The data contained in this section are based on tentative TOE and manning charts and should be used only for planning purposes and service school instruction.

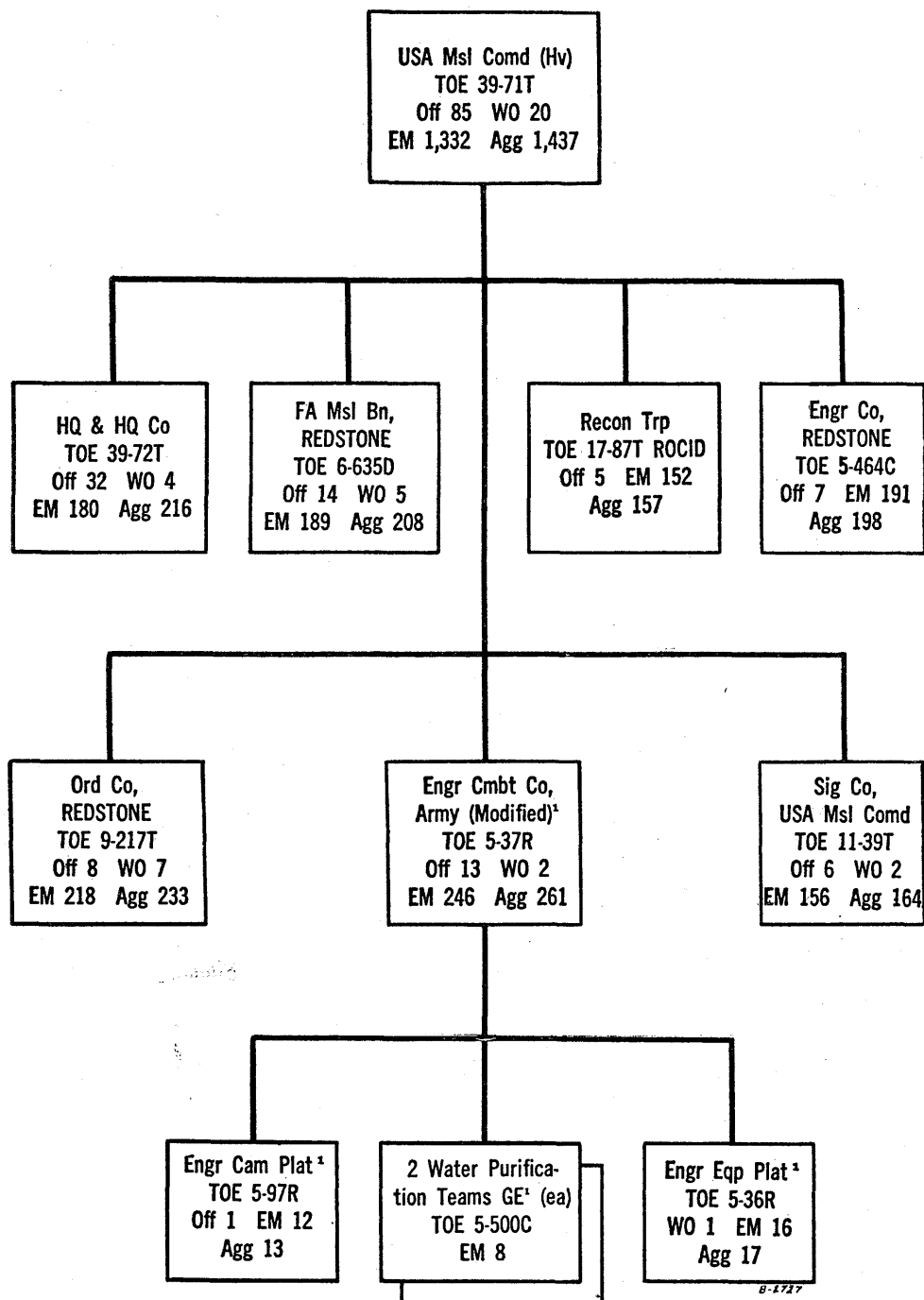
b. Capabilities.

- (1) Supports by atomic fire United States and Allied ground forces.
- (2) Delivers atomic fire on targets beyond

the range and power of other field artillery units.

- (3) Provides for mass destruction of large area targets and continuous fire support during displacement.
- (4) Provides organizational supply and maintenance of the missile, the missile system, and all other organic equipment.
- (5) Provides third echelon engineer, ordnance, and signal supply and maintenance.
- (6) Provides limited evacuation of wounded and minimum combat medical care.
- (7) Provides radiation detection and decontamination.
- (8) Supports itself logistically after resupply has been delivered to the command.

1.23. United States Army Missile Command (Heavy)



* Camouflage platoon, water purification teams, and equipment platoon augment the engineer combat company, army, and are included in the aggregate total strength shown for engineer combat company, army.

1.24. United States Army Missile Command (Heavy)—Weapons

1	2	3	4	5	6	7	8	9
Item	Total USA msl comd (hv)	HQ & HQ co	FA msl bn, RED- STONE	Engr cmbt co, army*	Recon trp	Engr co, RED- STONE	Ord co, RED- STONE	sig co, USA msl comd
2 Carbine, cal. .30-----	593	107	115	40	4	120	133	74
3 Gun, machine, cal. .30, Bng-----	33	3	5	6	15		3	1
4 Gun, machine, cal. .50, Bng-----	31		8	5		7	7	4
5 Gun, submachine, cal. .45-----	94	7		9	20	1	24	33
6 Launcher, GM, XM 30-----	2		2					
7 Launcher, rkt, 3.5-in-----	38	2	13	9	6	4	3	1
8 Mortar, 81-mm, on mount-----	3				3			
9 Pistol, auto, cal. .45-----	93	27	6		43		12	5
10 Rifle, auto, cal. .30-----	6				6			
11 Rifle, U.S., cal. .30-----	622	74	85	151	94	77	89	52
12 Gun, tank, 76-mm-----	7				7			
13 Individual weapons-----	1,441	218	211	206	182	198	261	165
14 Crew-served weapons-----	81	2	23	14	16	11	10	5
15 Total weapons-----	1,522	220	234	220	198	209	271	170

* Includes 1 engineer camouflage platoon, 2 water purification teams, and 1 engineer equipment platoon.

1.25. United States Army Missile Command (Heavy)—Vehicles and Major Equipment

1	2	3	4	5	6	7	8	9
Item	Total USA msl comd (hv)	HQ & HQ co	FA msl bn, RED- STONE	Engr cmbt co, army*	Recon trp	Engr co, RED- STONE	Ord co, RED- STONE	sig co, USA msl comd
<i>AIRCRAFT</i>								
2 Airplane, recon, high performance-----	4	4						
3 Airplane, utility-----	2	2						
4 Helicopter, utility-----	2	2						
5 Total aircraft-----	8	8						
<i>TRACKED VEHICLES</i>								
6 Carrier, pers, full-tracked-----	8				8			
7 Tank, cmbt, full-tracked, 76-mm gun-----	7				7			
8 Tank, recov veh, med-----	1				1			
9 Total tracked vehicles-----	16				16			
<i>WHEELED VEHICLES</i>								
10 Truck, amb, fld, ¾-ton-----	3	2	1					
11 Truck, cargo, ¼-ton-----	2			2				
12 Truck, cargo, ¾-ton, w/wo winch-----	73	14	13	4	1	4	17	20
13 Truck, comd, ¾-ton-----	1			1				
14 Truck, cargo, 2½-ton, w/wo winch-----	88	18	15	3		10	33	9
15 Truck, cargo, 5-ton-----	3		1			2		
16 Truck, dump, 2½-ton-----	12			12				
17 Truck, H202, servicing ¾-ton-----	2		2					
18 Truck, tank, gas, 2½-ton-----	3	3						
19 Truck, water, 2½-ton-----	2						2	
20 Truck, tractor, 5-ton, w/wo winch-----	67		12	4		44	7	
21 Truck, tractor, 10-ton-----	1		1					
22 Truck, utility, ¼-ton-----	91	19	19	5	18	2	20	8
23 Truck, van, shop, 2½-ton w/wo winch-----	9						9	
24 Truck, wrecker, med, 5-ton, w/wo winch-----	6		1			1	4	
25 Total wheeled vehicles-----	363	56	65	31	19	63	92	37

* See footnote at end of table.

1	2	3	4	5	6	7	8	9
Item	Total USA msl comd (hv)	HQ & HQ co	FA msl bn, RED- STONE	Engr embt co, army*	Recon trp	Engr co, RED- STONE	Ord co, RED- STONE	sig co, USA msl comd
TRAILERS								
26 Dolly trailer converter, 8-ton, 2-wheel	4		4					
27 Dolly trailer converter, 18-ton, 4-wheel	2					2		
28 Generator set assembly, gas eng, tlr mtd	1							1
29 Generator set, gas eng, tlr mtd	1							1
30 Semitrailer, low bed, 25-ton, 4-wheel	3		1			2		
31 Semitrailer, tank, gas, 12-ton, 4-wheel	4					4		
32 Semitrailer, van, cargo, 6-ton, 2-wheel	1					1		
33 Semitrailer, low bed, front loading, 20-ton	4			4				
34 Shop eqp, gen purpose, hv, semitr mtd	1					1		
35 Trailer, amph, cargo, ¼-ton, 2-wheel	20	15				1		4
36 Trailer, cargo, ¼-ton, 2-wheel	37		14	5	2		16	
37 Trailer, cargo, ¾-ton, 2-wheel	44	10	11		1	3	9	10
38 Trailer, cargo, 1½-ton, 2-wheel	79	16	13	5	1	4	35	5
39 Trailer, tank, water, 1½-ton, 2-wheel	8	2	1	1		1	2	1
40 Trailer, utility pole, type inf raft, 2½-ton, 2-wheel	11		2	9				
41 Trailer, utility pole, type triangulation tower, 2½-ton, 2-wheel	2						2	
42 Trailer, tandem, 10-ton, 4-wheel	1			1				
43 Total trailers	223	43	46	25	4	19	64	22
VEHICULAR EQUIPMENT								
44 Angledozer, cable op, 17,100-24,000 lb, DBP, tractor	1		1					
45 Compressor, reciprocating, power driven, trk mtd	3		2				1	
46 Compressor, gas driven, air, trk mtd	2			2				
47 Cooling tower, liquid, semitr mtd	1					1		
48 Crane, shovel, power unit, trk mtd, 25-ton (RED- STONE)	1						1	
49 Crane, shovel, trk mtd, 20-ton, gas driven	2			2				
50 Crane, shovel, trk mtd, 25-ton, gas driven	2		2					
51 Firefighting eqp set, w/trk and tlr	5		2			3		
52 Firefighting eqp, w/trk, set No. 21, Army acft crash	1	1						
53 Generating and charging plant, oxygen-nitrogen, semitlr mtd, w/van type body	10					10		
54 Generating and charging plant, carbon dioxide, semitlr mtd, mtr driven	1					1		
55 Grader, road, mtzd, diesel driven	2			2				
56 Power control unit, cable op, DBP, tractor	1		1					
57 Semitr, ALC, 9-ton, 3,000-gal, 2-wheel (RED- STONE)	5		2				3	
58 Semitr, van component, test and checkout	1						1	
59 Semitr, aux wkr, 12-ton, 4-wheel, w/winch (RED- STONE)	3		2				1	
60 Semitr, LOX, 9-ton (REDSTONE)	4		4					
61 Set, fueling eqp (REDSTONE), mtd on aux tlr	2		2					
62 Shop eqp, org rep, lt, trk mtd, set No. 2	1					1		
63 Shop eqp, contact maint, trk mtd, set No. 3	4					3	1	
64 Shop, van, 2½-ton, fire control and test (RED- STONE)	3		2				1	
65 Solidifying plant, liquid, semitr mtd	1					1		
66 Storage unit, low pressure, liquid-oxygen, semitr mtd	12					12		
67 Tractor, full-tracked, low speed, diesel driven, convl xmsn, 8,600-12,000 DBP	1			1				
68 Tractor, full-tracked, low speed, diesel driven, convl xmsn, 17,100-24,000 DBP	1		1					

* See footnote at end of table.

	1	2	3	4	5	6	7	8	9
1	Item	Total USA msl comd (hv)	HQ & HQ co	FA msl bn, RED- STONE	Engr cmbt co, army*	Recon trp	Engr co, RED- STONE	Ord co, RED- STONE	Sig co, USA msl comd
69	Tractor, full-tracked, low speed, diesel driven, convl xmsn, 17,100-24,000 DBP, w/angledozer, earth, mov cable-----	2			2				
70	Tractor, full-tracked, low speed, diesel driven, convl xmsn, 17,100-24,000 DBP, w/bulldozer, earth, mov cable-----	1			1				
71	Van, shop, 2½-ton, pneumatic checkout and rep-----	1						1	
72	Welding eqp, set No. 1, tlr mtd-----	1						1	
73	Winch, towing, DBP, tractor, for caterpillar, D-7----	1		1					

* Includes 1 engineer camouflage platoon, 2 water purification teams, and 1 engineer equipment platoon.

CHAPTER 2 PERSONNEL

Section I. GENERAL

2.1. General

This chapter provides personnel data for staff officers on division, corps, army, communications zone sections, communications zone, and theater staffs within a theater of operations.

a. Section I outlines the contents of the chapter.

b. Section II enables the staff officer to estimate losses and the requirements for replacements in—

- (1) *Combat zone forces of division size or greater, both for short periods of a particular type of combat action and for longer periods containing a variety of types of action.*

(2) *The communications zone.*

(3) *Theaters of operation.* Two methods of varying accuracy are given. In each case, loss estimates are given for the unit concerned as a whole with breakdowns by branch of service.

c. Section III gives a basis for estimates of prisoners of war by giving experience data under varying conditions of World War II.

d. Section IV gives a basis for estimates of decorations and mail by giving experience data from World War II and Korea.

e. Section V guides the staff officer in making the internal arrangements of division, corps, and army headquarters.

Section II. LOSSES AND REPLACEMENTS*

2.2. General

A personnel loss is any reduction in the assigned strength of a unit. These losses are caused primarily by enemy action, disease, accidents, and administrative action. The rate of loss varies with the theater of operations, climate, terrain, condition and state of training of troops, type of activity, the enemy, and numerous other factors. Each division and corps has its own loss experience dependent upon its own situation. Loss rates by arm or service and by military occupational specialty within corps and division vary with the amount of exposure of the particular category of personnel to the various causes of losses.

a. *Categories of Losses.* Personnel losses result from three general categories.

- (1) *Battle casualties.* Those losses incurred in action including—

- (a) Killed in action.
- (b) Died of wounds and injuries received in action.
- (c) Wounded or injured in action.
- (d) Missing in action or captured by the enemy.

- (2) *Nonbattle casualties.* These losses include—

- (a) Dead, nonbattle.
- (b) Missing, nonbattle.
- (c) Evacuated sick and injured, nonbattle.

- (3) *Administrative losses.* Attrition from this category is relatively small and dependent upon current administrative policies. These losses include—

- (a) Transfers to other units, disciplinary barracks, etc.
- (b) Absent without leave and desertion.
- (c) Rotational personnel.
- (d) Discharges.

b. *Gross Losses.* In addition to those killed, captured, or missing, gross losses include those evacuated to hospitals and dropped from the rolls of their units. In division, corps, and army units, any man evacuated to a hospital is dropped from unit rolls and carried on the rolls of the Department of the Army Medical Holding Detachment and is not chargeable against the authorized theater strength. In the communications zone, men are dropped from unit rolls after they remain in hospitals over 90 days or

*Losses and strengths considered herein do not include Air Force personnel.

when it is foreseen that they will be hospitalized in excess of 90 days.

c. Net Losses. Net losses are gross losses less those returned to duty within the theater. Net losses are computed only at theater level and are used as a basis for estimates of personnel required from the zone of interior to maintain theater strength.

d. Loss Experience. Factors and figures which appear in the tables of this section are based primarily upon World War II and the Korean Conflict experience and will not apply necessarily during another war. For future planning, loss experience of past wars must be modified by evaluating new factors applicable to new conditions. As a war progresses, every echelon of command gradually builds up loss experience which more accurately reflects the current conditions. *It is emphasized that even the most complete and accurate figures relating to past wars should not be relied upon as valid for any future war.* With past experience as a basis, good judgment and sound knowledge of principles must be used to develop new experience tables applicable to new conditions. Administrative losses are based on changing policies and are not adaptable to the establishment of loss tables based on past experience. For this reason, experience tables for administrative losses are not included in this manual.

2.3. Atomic Loss Estimates

a. General. The use of atomic weapons by the enemy against United States forces will result in increased battle casualties. Battle casualties from atomic weapons may be divided into two general categories:

- (1) Battle casualties sustained when a military unit is destroyed. The magnitude of such losses is so great that replacement with individuals is not feasible. Replacements for these battle casualties will be provided for by unit replacement.
- (2) Battle casualties sustained by units which are on the periphery of the area of damage. Replacements for battle casualties in this category will be provided from survivors of destroyed units and by personnel in the individual replacement system.

b. Factors Influencing Losses. No valid ex-

perience data exist from which loss experience tables can be compiled. The problem of estimating the number of replacements (both unit and individual) required to replace losses to atomic weapons contains many variable factors. Among the more important of these factors are—

- (1) Frequency of enemy employment of atomic weapons.
- (2) Types and yields of weapons employed.
- (3) Types of targets selected for atomic weapon attack.
- (4) Effectiveness of enemy target location system.
- (5) Accuracy of enemy delivery means.
- (6) Protective measures adopted by own forces.

c. Estimation of Battle Casualties. Effective battle casualty estimation requires an aggressive effort on the part of all agencies, particularly intelligence agencies, to provide specific data to eliminate the variable factors outlined in *b* above or to permit reasonable assumptions to be made concerning these variable factors. The validity of battle casualty estimation will be directly proportional to the degree of refinement which can be made in these factors.

2.4. Unit Replacements

Each theater army will be authorized separate units to be employed as replacements for units which may be rendered ineffective as a result of an atomic attack. The numbers and types of units furnished will be determined by the Department of the Army based upon the recommendations of the theater commander (par. 2.3).

2.5. Combat Zone Estimates

a. General. The procedures and data contained in this paragraph are applicable to the estimation of nonatomic losses. Because of the possible magnitude of atomic battle casualties and the effect which such losses may have on tactical operations, atomic battle casualties should be estimated separately.

b. Purpose of Estimate. Personnel loss estimates at corps and division levels are used to anticipate the effect of losses on the tactical plan and to prepare for the handling of replacements within the commands. The estimates must answer three questions—the strength at any given time, the losses to be anticipated for

a specific situation, and the distribution of these losses by arm or service and military occupational specialty. Combat estimates are of two types—short-period estimates (5 days or less), and long-period estimates (over 5 days). Estimates at army level are used for the same purposes as at corps and division levels. In addition, they are used as a basis for allocation of available replacements and to inform higher headquarters of anticipated replacement requirements. Army and corps headquarters use both short-period estimates (5 days or less) and long-period estimates (over 5 days). Divisions normally use only short-period estimates.

c. *Factors.* In calculating losses, there are two major factors to be considered:

- (1) Loss rates applicable to the specific situation are expressed as percentage of strength or as number per thousand of average strength of any given period. In compilation and use of loss data, units whose loss rates are about the same because of similar operating conditions are grouped together.
- (2) Loss rates are applied to the strength

of the particular command under consideration. There are two different strengths used:

- (a) *Authorized strength* is table of organization and equipment strength plus any additional personnel authorized by higher headquarters. Authorized strength is used in long-range planning and when the assigned strength is unknown or rapidly fluctuating.
- (b) *Assigned strength* includes all personnel carried as assigned on the unit's roster. Assigned strength is used when known in long-period estimates if it differs materially from authorized strength and if it will remain reasonably stable during the estimate period.

d. *Short-Period Estimates (periods not in excess of 5 days).*

- (1) *Daily personnel losses as percentage of strength.* (Do not use this table for loss-estimate periods over 5 days.)

1	2	3	4	5	6	7	8	9	10
General type of operations for the force as a whole	Divisions in contact			Divisions in corps and army reserve			Nondivisional units, corps, and army ¹		
	Battle casualty percentage	Non-battle casualty percentage	Total percentage	Battle casualty percentage	Non-battle casualty percentage	Total percentage	Battle casualty percentage	Non-battle casualty percentage	Total percentage
2 Covering and security force action.....	0.9	0.3	1.2	0.3	0.3	0.6	0.3	0.1	0.4
3 ATTACK:									
4 Meeting engagement.....	2.4	0.3	2.7	0.3	0.3	0.6	0.4	0.1	0.5
5 Of a position—1st day.....	3.8	0.3	4.1	0.4	0.3	0.7	0.5	0.1	0.6
6 Succeeding days.....	1.9	0.3	2.2	0.3	0.3	0.6	0.4	0.1	0.5
7 Of a fortified zone—1st day.....	6.3	0.3	6.6	0.5	0.3	0.8	0.7	0.1	0.8
8 Succeeding days.....	3.2	0.3	3.5	0.4	0.3	0.7	0.5	0.1	0.6
9 DEFENSE:									
10 Meeting engagement.....	1.5	0.3	1.8	0.3	0.3	0.6	0.3	0.1	0.4
11 Of a position—1st day.....	1.9	0.3	2.2	0.3	0.3	0.6	0.4	0.1	0.5
12 Succeeding days.....	1.0	0.3	1.3	0.3	0.3	0.6	0.3	0.1	0.4
13 Of a zone—1st day.....	3.2	0.3	3.5	0.4	0.3	0.7	0.5	0.1	0.6
14 Succeeding days.....	1.6	0.3	1.9	0.3	0.3	0.6	0.4	0.1	0.5
15 Inactive situations ²	0.7	0.3	1.0	0.3	0.3	0.6	0.3	0.1	0.4
16 Pursuit.....	1.3	0.3	1.6	0.3	0.3	0.6	0.3	0.1	0.4
17 Retirement and delaying action.....	0.7	0.3	1.0	0.3	0.3	0.6	0.3	0.1	0.4

¹ Use divisional loss rates for units attached to a division.

² Forces in contact—neither side attacking.

(2) *Distribution of battle casualties by branch (divisions).*

	1	2	3	4
1	Branch	Infantry division (percentage)	Armored division (percentage)	Airborne division (percentage)
2	Infantry----	93.0	62.0	85.6
3	Artillery----	2.4	3.6	6.9
4	Armor-----	2.0	23.1	0
5	Engineers----	1.5	3.3	3.9
6	All others----	1.1	8.0	3.6

(3) *Distribution of infantry battle casualties by selected military occupational specialty within an infantry division.* The combat effectiveness of an infantry division is most seriously affected by the personnel losses of its five infantry battle groups. A total of 87.4 percent of the infantry battle casualties occurs among riflemen and heavy weapons crewmen (and closely allied specialists), who constitute the larger portion of the infantry battle group's strength.

(4) *Distribution of nonbattle casualties.* Nonbattle casualties in each branch are in the same proportion to the total nonbattle casualties as the strength of that branch is to the total strength of the unit.

(5) *Example.* Calculate the total non-atomic losses of a frontline infantry division in the first 3 days of the defense of a position and determine the number of infantry riflemen and heavy weapons crewmen who become battle casualties.

(a) *Total losses.**

Authorized strength of division (TOE)-----	13,748
Assigned strength of division (assumed), beginning of first day-----	13,483
Losses, first day, defense of position ($2.2\% \times 13,483$ —(1) above, line 9, col. 4)-----	297
Assigned strength, end of first day-----	13,186
Losses, second day, defense	

of position ($1.3\% \times 13,186$ —(1) above, line 10, col. 4)-----	171
Assigned strength, end of second day-----	13,015
Losses, third day, defense of position ($1.3\% \times 13,015$ —(1) above, line 10, col. 4)-----	169
Assigned strength, end of third day-----	12,846
Total losses, 3 days ($297+171+169$)-----	637

(b) *Battle casualties.*

First day, defense of position ($1.9\% \times 13,483$ —(1) above, line 9, col. 2)-----	256
Second day, defense of position ($1.0\% \times 13,186$ —(1) above, line 10, col. 2)-----	131
Third day, defense of position ($1.0\% \times 13,015$ —(1) above, line 10, col. 2)-----	130
Total battle casualties-----	517

(c) *Infantry battle casualties*

($93\% \times 517$ —(2) above, line 2, col. 2)-----	480
Infantry riflemen and heavy weapons crewmen battle casualties ($87.4\% \times 480$ —(3) above)-----	419

e. *Long-Period Estimates—Combat Zone (periods in excess of 5 days).*

(1) *Monthly personnel losses.*

(a) The percentages given in the following table are average figures for all theaters in World War II.

	1	2	3
1	Troops	Battle casualties—percentage per month	Nonbattle casualties—percentage per month
2	Infantry division in combat zone-----	10	8
3	Armored divisions in combat zone-----	8	7
4	Corps and army nondivisional troops in combat zones-----	1.25	3.0

*Calculations based upon World War II loss rate tables.

(b) The percentages given in the following table are based upon average Korean conflict experience 25 June 1950 to 25 July 1953.

Infantry Divisions

1	1	2	3	4		
	Type of operation	Battle casualties per division per day	Battle casualties per division— percentage per month*	Status distribution—percentage		
				Killed	Wounded	Missing
2	Offensive:					
	Against main enemy force.....	67	11.2	14.6	83.2	2.3
	Against delaying force—					
	Organized.....	26	4.3	18.2	69.6	12.2
	Partly disorganized.....	12	2.0	18.8	75.9	5.3
	Against fortified hill positions.....	34	5.7	17.5	79.4	3.1
3	Defensive:					
	Against main enemy force.....	77	12.8	25.2	68.8	6.2
	Main pressure on non-US units.....	35	5.8	16.1	70.6	13.2
4	Withdrawal.....	119	19.8	15.2	44.5	40.2
5	Positional warfare.....	6	.01	18.6	75.0	6.4

*Based upon assumed average divisional strength of 18,000.

(2) Types of battle casualties as percentage of total battle casualties.

1	2	3	4
Battle casualties	Infantry divisions percentage	Armored divisions percentage	Corps and army nondivisional units percentage
2 Killed.....	16.5	18.0	16.0
3 Wounded.....	70.0	72.0	84.0
4 Captured and missing.....	13.5	10.0	Negligible

(3) Distribution of losses by branch within divisions. See d(2) and (4) above.

(4) Distribution of battle casualties by branch within corps and larger units in the combat zone as percentage of total battle casualties.

1	2	3	
	Branch	Percentage	
		World War II	Korea
2	Infantry.....	81.9	81.1
3	Artillery.....	4.5	5.7
	Field.....	(3.6)	
	Antiaircraft.....	(0.9)	
4	Armor.....	6.6	5.3
5	Corps of Engineers.....	3.2	7.9
6	Army Medical Service.....	2.8	
7	Signal Corps.....	0.2	
8	Quartermaster Corps.....	0.1	
9	Ordnance Corps.....	0.2	
10	Transportation Corps.....	0.3	
11	Chemical Corps.....	0.1	7.9
12	Military Police Corps.....	0.1	
13	Miscellaneous.....	0.1	

Note. The percentage figures given in the World War II portion of this table are the field battle casualty distribution as reported through machine record unit channels, European Theater of Operations, for the period 6 June 1944 through 31 March 1945. The figure for armor combines the percentages originally reported as armored forces (2.9 percent), tank destroyer (1.4 percent), and cavalry (2.3 percent). In actual operations, the distribution of battle casualties by branch varies with the composition of the force, type of operation, etc.

(5) Distribution of nonbattle casualties. See d(4) above.

(6) Example. Calculate the number of replacements required to bring I Corps up to authorized strength and to maintain it at that strength in combat for 15 days, assuming no atomic losses, given—

	Authorized strength	Assigned strength
Three infantry divisions	41,244	39,216
One armored division	14,600	13,871
Corps nondivisional troops	36,405	34,755
Total corps	92,249	87,842

(a) Replacements needed now.

Authorized (92,249)—assigned (87,842) 4,407

(b) Estimated losses, 15 days.

Infantry divisions ((1) above, line 2):

Battle casualties $\frac{1}{2} \times 10\%$	
$\times 41,244$	2,062
Nonbattle casualties $\frac{1}{2} \times 8\% \times 41,244$	1,650

One armored division ((1) above, line 3):
 Battle casualties $\frac{1}{2} \times 8\%$
 $\times 14,600$ ----- 584
 Nonbattle casualties $\frac{1}{2} \times 7\% \times 14,600$ ----- 511
 Corps nondivisional troops ((1) above, line 4):
 Battle casualties $\frac{1}{2} \times 1.25\% \times 36,405$ ----- 228
 Nonbattle casualties $\frac{1}{2} \times 3.0\% \times 36,405$ ----- 546
 Total losses for 15 days ----- 5,581

(c) Total replacements required.
 Replacements needed now-- 4,407

Losses for 15-day period----- 5,581
 Total ----- 9,988

f. Special Estimates for Airborne Operations.

(1) Personnel losses for airborne forces conducting an assault airborne operation may be estimated by applying the applicable daily loss rates from the following table to the assigned strengths of the units actually committed in the objective area or en route thereto.

Note. Rates in this table are for planning purposes only. The rates for each airborne operation are different. The rates in this table are useful as a guide or for use in practicing estimate procedures.

Forces en route	First day (percentage)			Succeeding days ¹ (percentage)		
Parachute-----	0.2			-----		
Assault aircraft ² -----	1.5			-----		
Air-landed ³ -----	0.5			0.5		
Forces in airhead	Percentages			Percentages		
	Nonbattle casualty	Battle casualty	Total	Nonbattle casualty	Battle casualty	Total
Airborne divisions and attached troops:						
Parachute-----	0.3	8	8.3	0.3	2	2.3
Assault aircraft-----	0.3	4	4.3	0.3	2	2.3
Air-landed infantry division and attached troops-----	0.3	43.8	4.1	0.3	2	2.3
Corps troops (includes followup echelon)-----	0.3	1	1.3	0.3	1	1.3
Followup echelons of divisions and attached troops-----	0.3	2	2.3	0.3	2	2.3

¹ Upon link up or when forces in the objective area are firmly established, rates and methods given in *d* or *e* above for an infantry division are applicable.

² Includes only those forces landed by assault aircraft during the assault phase.

³ Includes all units and echelons landed by air after the assault phase.

⁴ This rate applies for first day of offensive action.

(2) *Example.* Calculate the number of nonatomic losses which will be sustained by the 102d Airborne Division on D-day and D + 1. Takeoff times and H-hour are on D-day. Computations for followup and rear echelons are omitted from this example. Strength of the division plus attachments (65 attached personnel) echeloned as follows:

102d Airborne Division	Strength
111,772	
Parachute element	(8,698)
Assault aircraft element	² (1,332)
Followup and rear echelons	(1,742)

En route:

(a) Parachute ($8,698 \times 2\%$) 174
 (b) Assault aircraft ($1,332 \times 1.5\%$) ----- 20
 (c) Total losses en route --- 194

Airhead—first day:

(a) Parachute ($8,698 - 174 \times 8.3\%$) ----- 707
 (b) Assault aircraft ($1,332 - 20 \times 4.3\%$) ----- 56
 (c) Total losses in airhead—first day ----- 763

¹ Division strength is estimated, based on recommended changes to TOE 57T ROTAD; accurate figures appear in series TOE 57D.

² Includes 128 personnel from the aviation company who fly in with organic aircraft.

First day losses (194 + 763) -- 957
 Airhead D + 1 losses (10,030
 — 957) × 2.3% ----- 209
 Total losses D-day and
 D + 1 (957 + 209) -- 1,166

g. Special Estimates for Amphibious Operations.

(1) Nonatomic personnel losses for am-

phibious forces establishing a beachhead may be estimated by applying the applicable daily loss rates from the following table to the *assigned* strength of units actually committed in the beachhead or en route thereto.

Note. Rates in this table are for planning purposes only. The rates for each amphibious operation are different. The rates in this table are for use as a guide only or in practicing estimate procedure.

	1	2	3	4	5	6	7	8	9
1		Phase I—Forces en route		Phase II—Forces in beachhead					
2		Daily at sea ¹	Landing	First day			Succeeding days ²		
3		Nonbattle and battle casualty (percentage)	Battle casualty (percentage)	Nonbattle casualty (percentage)	Battle casualty (percentage)	Total ³ (percentage)	Nonbattle casualty (percentage)	Battle casualty (percentage)	Total ³ (percentage)
4	Assault forces: ⁴								
5	Divisions and attached troops	0.5	1.3	0.3	5.3	5.6	0.3	1.5	1.8
6	Corps and army troops	0.5	1.0	0.3	3.0	3.3	0.3	1.0	1.3
7	Followup forces: ⁵								
8	Divisions and attached troops	0.5	0.5				0.3	1.5	1.8
9	Corps and army troops	0.5	0.5				0.3	1.0	1.3

¹ Rates in this column include both battle casualties and nonbattle casualties en route and are distributed by arm or service in the same proportion to the total losses as the strength of each arm or service is to the strength of the total force being transported.

² After beachhead is secure and forces are building up for the breakout (phase III), the rates and methods given in d(1) or e(1) above are applicable. The rates in this table are applicable only until the beachhead is firmly established.

³ Losses are distributed as given in d(4) above for nonbattle casualties; d(2) or e(4) above for battle casualties by arm or service; d(2) above for battle casualties by category (killed, wounded, captured, and missing).

⁴ Assault forces in this table are those units who make their landings in the face of enemy opposition at or near the beachhead. For purposes of computing total division rates, it was assumed that an assault division lands 2 battle groups by helicopter behind the beaches and 2 battle groups abreast over the beaches, followed by the reserve battle group and the remainder of the division.

⁵ Followup forces in this table include those landing over beaches secured by other friendly forces.

(2) The amount and type of reinforcement required by divisions making amphibious landings will be different for each operation because of the necessity to tailor the force to fit the mission, area of operations, lift available, and the enemy situation.

(3) *Example.* Calculate the total number of nonatomic losses which will be sustained during an amphibious operation by I Corps on D — 1, D-day, and D + 1.

	Assigned strength
1st Infantry Division -----	13,748
2d Infantry Division -----	13,748
3d Infantry Division -----	13,748
Nondivisional troops, assault echelon -----	19,252
Nondivisional troops, followup echelon -----	33,638
Total I Corps -----	94,134
Total I Corps will sail on D — 1 at	

assigned strength. On D-day the 1st and 2d Infantry Divisions will each assault the beach with 2 battle groups in helicopter assault and 2 battle groups abreast in a waterborne assault. 3d Infantry Division and non-divisional troops in followup echelon will land on D + 1.

D — 1:

(a) *Losses at sea.*

1. Assault divisions	
27,496 × 0.5% (table, col. 2, line 4) -----	137
2. Nondivisional assault troops	
19,252 × 0.5% (table, col. 2, line 5) -----	96
3. Followup division	
13,748 × 0.5% (table, col. 2, line 6) -----	69
4. Nondivisional followup troops	
33,638 × 0.5% (table, col. 2, line 7) -----	168
5. Total I Corps D — 1 losses -----	470

D-day:

(b) *Assault landing.*

1. Assault divisions
(27,496 — 137) × 1.3%
(table, col. 3, line 4) ----- 356
2. Nondivisional assault troops
(19,252 — 96) × 1.0%
(table, col. 3, line 5) ----- 192

(c) *Nonbattle casualties.*

1. Assault divisions
(27,496 — 137 — 356) ×
0.3% (table, col. 4, line
4) ----- 81
2. Nondivisional assault troops
(19,252 — 96 — 192) ×
0.3% (table, col. 4, line 5) 57

(d) *Battle casualties.*

1. Assault divisions
(27,496 — 137 — 356) ×
5.3% (table, col. 5, line 4) 1,431
2. Nondivisional assault troops
(19,252 — 96 — 192) ×
3.0% (table, col. 5, line 5) 569

(e) *Losses at sea.*

1. Followup division
(13,748 — 69) × 0.5%
(table, col. 2, line 6) ----- 68
2. Nondivisional followup troops
(33,638 — 168) × 0.5%
(table, col. 2, line 7) ----- 167

(f) *Total I Corps D-day losses.*

(b) + (c) + (d) + (e) -- 2,921

D + 1:

(g) *Landing losses.*

1. Followup division
(13,748 — 69 — 68) ×
0.5% (table, col. 3, line 6) 68
2. Nondivisional followup troops
(33,638 — 168 — 167) ×
0.5% (table, col. 3, line 7) 167

(h) *Beachhead losses.*

1. Assault divisions
(27,496 — 137 — 356
— 81 — 1,431) × 1.8%
(table, col. 9, line 4) ----- 459
2. Nondivisional assault troops
(19,252 — 96 — 192 — 57
— 569) × 1.3% (table,
col. 9, line 5) ----- 238
3. Followup division
(13,748 — 69 — 68 — 68)
× 1.8% (table, col. 9, line
6) ----- 244
4. Nondivisional followup troops
(33,638 — 168 — 167
— 167) × 1.3% (table, col.
9, line 7) ----- 431

(i) *Table I Corps D + 1 losses.*

(g) + (h) ----- 1,607

(4) Worksheet form—personnel loss estimates—amphibious operations.

1	2	3	4	5	6	7	8	9	10
	D —1			D-day			D +1		
	Rate (per-centage)	Strength	Losses	Rate (per-centage)	Strength	Losses	Rate (per-centage)	Strength	Losses
2	Phase I—Force at sea:								
3	Assault divisions.....	.5	27,496	137					
4	Nondivisional assault troops.....	.5	19,252	96					
5	Followup division.....	.5	13,748	69	0.5	13,679	68		
6	Nondivisional followup troops.....	.5	33,638	168	.5	33,470	167		
7	Landing:								
8	Assault divisions.....				1.3	27,359	356		
9	Nondivisional assault troops.....				1.0	19,156	192		
10	Followup division.....						0.5	13,611	68
11	Nondivisional followup troops.....						.5	33,303	167
12	Total—Phase I.....			470					235
13	Phase II—Forces in beachhead:								
14	Assault divisions:								
15	Nonbattle casualties.....				.3	27,003	81	1.8	25,491
16	Battle casualties.....				5.3	27,003	1,431		459
17	Nondivisional assault troops:								
18	Nonbattle casualties.....				.3	18,964	57	1.3	18,338
19	Battle casualties.....				3.0	18,964	569		238
20	Followup division.....							1.8	13,542
21	Nondivisional followup troops.....							1.3	33,136
22	Total—Phase II.....						2,138		1,372

2.6. Communications Zone Estimates

a. In estimating the nonatomic gross losses for all ground troops in the communications zone, battle casualties are considered negligible, and nonbattle casualties are calculated at 0.5 percent per month. Arm or service distribution of nonbattle casualties is determined by applying this nonbattle casualty percentage to the strength of each arm or service in the command considered.

b. Before estimates of losses to atomic weapons can be made, certain information on enemy capabilities must be secured (par. 2.3). If specific information cannot be obtained, appropriate assumptions must be made. By applying target analysis methods to selected critical target areas, a basis for estimating atomic losses can be evolved.

2.7. Theater Estimates—Nonatomic

a. *General.* The following tables are based on U. S. Army experience in World War II in all theaters. Approximately 6½ percent of the losses were officers. In specific areas, the distribution of battle casualties by arm or service varies with the composition of the theater, types of operations, etc.

(1) Gross losses.

1	2
Type of loss	Percentage of total theater strength per month
2 Nonbattle casualties.....	4.20
3 Battle casualties.....	4.08
4 Killed.....	(0.60)
5 Wounded.....	(3.00)
6 Captured and missing.....	(0.48)

(2) *Distribution of battle casualties by type and branch.*

1	Branch	2	3	4	5	6
		Percentage of branch's battle casualties by type				
		Killed	Wounded	Missing	Captured	Total
2	Infantry.....	17.3	71.2	2.8	8.7	100.0
3	Artillery.....	14.3	61.6	3.1	21.0	100.0
	Field.....	(15.7)	(68.0)	(2.7)	(13.6)	(100.0)
	Antiaircraft.....	(10.5)	(43.8)	(4.1)	(41.6)	(100.0)
4	Armor.....	19.0	70.8	1.7	8.5	100.0
5	Corps of Engineers.....	18.8	66.9	2.6	11.7	100.0
6	Army Medical Service.....	15.3	66.4	2.9	15.4	100.0
7	Signal Corps.....	17.2	55.5	4.5	22.8	100.0
8	Quartermaster Corps.....	18.6	42.9	6.6	31.9	100.0
9	Ordnance Corps.....	16.1	43.4	5.7	34.8	100.0
10	Transportation Corps.....	24.1	69.2	5.9	0.8	100.0
11	Chemical Corps.....	22.7	65.3	1.3	10.7	100.0
12	Military Police Corps.....	18.1	71.6	1.3	9.0	100.0
13	Miscellaneous.....	18.8	36.8	13.6	30.8	100.0
14	Total.....	17.2	69.8	2.8	10.2	100.0

1	Branch	Percentage of each type of battle casualty by branch				
		Killed	Wounded	Missing	Captured	Total
2	Infantry.....	80.9	82.0	79.5	68.5	80.5
3	Artillery.....	5.9	6.3	7.6	14.6	7.1
	Field.....	(4.8)	(5.1)	(4.9)	(6.9)	(5.2)
	Antiaircraft.....	(1.1)	(1.2)	(2.7)	(7.7)	(1.9)
4	Armor.....	3.8	3.6	2.1	2.9	3.5
5	Corps of Engineers.....	4.0	3.5	3.3	4.2	3.6
6	Army Medical Service.....	2.6	2.8	2.9	4.4	2.9
7	Signal Corps.....	0.5	0.4	0.8	1.1	0.5
8	Quartermaster Corps.....	0.6	0.4	1.4	1.8	0.6
9	Ordnance Corps.....	0.4	0.2	0.8	1.4	0.4
10	Transportation Corps.....	0.2	0.1	0.3	0.0	0.1
11	Chemical Corps.....	0.6	0.4	0.2	0.4	0.4
12	Military Police Corps.....	0.2	0.2	0.1	0.1	0.2
13	Miscellaneous.....	0.3	0.1	1.0	0.6	0.2
14	Total.....	100.0	100.0	100.0	100.0	100.0

Note. Percentages for armor are composite figures grouping cavalry and armored force operations.

b. Estimation of Losses.

(1) *First method.* Gross losses may be estimated by the following method, which is more accurate than (2) below because of frequent changes in organization within a theater.

(a) Determine battle casualties and nonbattle casualties of combat zone troops (par. 2.5).

1. Divisional.
2. Nondivisional.

(b) Determine nonbattle casualties of troops in the communications zone (par. 2.6).

(c) Add (a) and (b) above.

(2) *Second method.* In a well-established theater, at theater army level, losses may be estimated by the following formula:

(a) $R \times T \times S = \text{losses per month.}$

R = a conversion factor (the ratio of the actual losses to the

assumed losses upon which T factors are based).

T = empirical loss rate factor expressed in numbers per 1,000. (See (3) below for empirical loss rate factors.)

S = theater army strength in thousands.

(b) The formula in (a) above may be used to compute gross losses, net losses, or returns to duty, depending upon the T factor utilized.

(c) Losses in numbers per month may be converted to percentages per month by multiplying by 30 and dividing by 10 (net factor of 3).

(3) T factors.

(a) The T factors shown in the following tables are based upon the assumptions contained in 1, 2, and 3 below. Only the losses which occur during the period starting with the first day of the tables have been con-

sidered in the derivation of the factors. The changes in net losses or returns to duty within the theater resulting from losses which occur prior to the date starting with the first day of the tables must be computed separately.

1. Disease and nonbattle injuries—1 per 1,000 per day

2. Battle injuries (including killed in action (KIA) and wounded in action (WIA))—1.2 per 1,000 per day

WIA = 1.0 per 1,000 per day

$\frac{KIA}{WIA} = \frac{1}{5}$

KIA = .2 per 1,000 per day

WIA + KIA = 1.2 per 1,000 per day

3. Captured and missing—1 per 1,000 per day

(b) T factors for cumulative gross losses.¹

	1	2	3	4	5	6	7	8
1	Type of loss	30 days	60 days	90 days	120 days	150 days	180 days	360 days
2	Disease and nonbattle injuries ²	30	60	90	120	150	180	360
3	Battle Casualties:							
	a. Captured and missing.....	30	60	90	120	150	180	360
	b. Other battle casualties ³	36	72	108	144	180	216	432

¹This table is prepared by multiplying the rates given in (a) above by the number of days in the period under consideration. For fractional periods of a month, use the proportional part of the monthly factor; thus, for 10 days use 10/30 of the 30-day factor.

²This category includes hospital cases, deaths, and admissions sent to the zone of interior.

³This category includes hospital cases, killed in action, died in hospital, and admissions sent to the zone of interior.

(c) Construction of basic graphs for the derivation of T factors for returns to duty within the theater and theater net losses.

1. Basic data for the construction of the gross loss lines (① on the graphs in 3 below) were taken from (b) above.

2. Basic data for the construction of returns-to-duty lines (② on the graphs in 3 below) were taken from the following table.

(a) Returns to duty within the theater from hospitals as percentage of hospital admissions.

	1	2	3	4	5
1	Days after admission	Within time period		Cumulative at end of period	
		Battle casualty	Nonbattle casualty	Battle casualty	Nonbattle casualty
2	0-15.....	15.3	61.0	15.3	61.0
3	15-30.....	15.2	20.7	30.5	81.7
4	30-45.....	11.7	4.5	42.2	86.2
5	45-60.....	8.5	4.4	50.7	90.6
6	60-75.....	5.2	1.2	55.9	91.8
7	75-90.....	3.6	1.2	59.5	93.0
8	90-105.....	2.7	0.2	62.2	93.2
9	105-120.....	2.6	0.2	64.8	93.4

Source: ETO, GFRC History 1944-45.

- (b) *Returns to duty from captured and missing status.* Approximately 30 percent of the personnel losses in this category during any given month are recovered for duty within the theater during the same month. Returns to duty from captured and missing status in succeeding months are indeterminable and should be disregarded in making estimates.
- (c) *Limited assignment personnel.* Of the personnel who return to duty within the theater from hospitals, the following per-

centages are limited assignment:

Under 30-day or 60-day evacuation policies:

8 percent of the battle casualties.

5 percent of the nonbattle casualties.

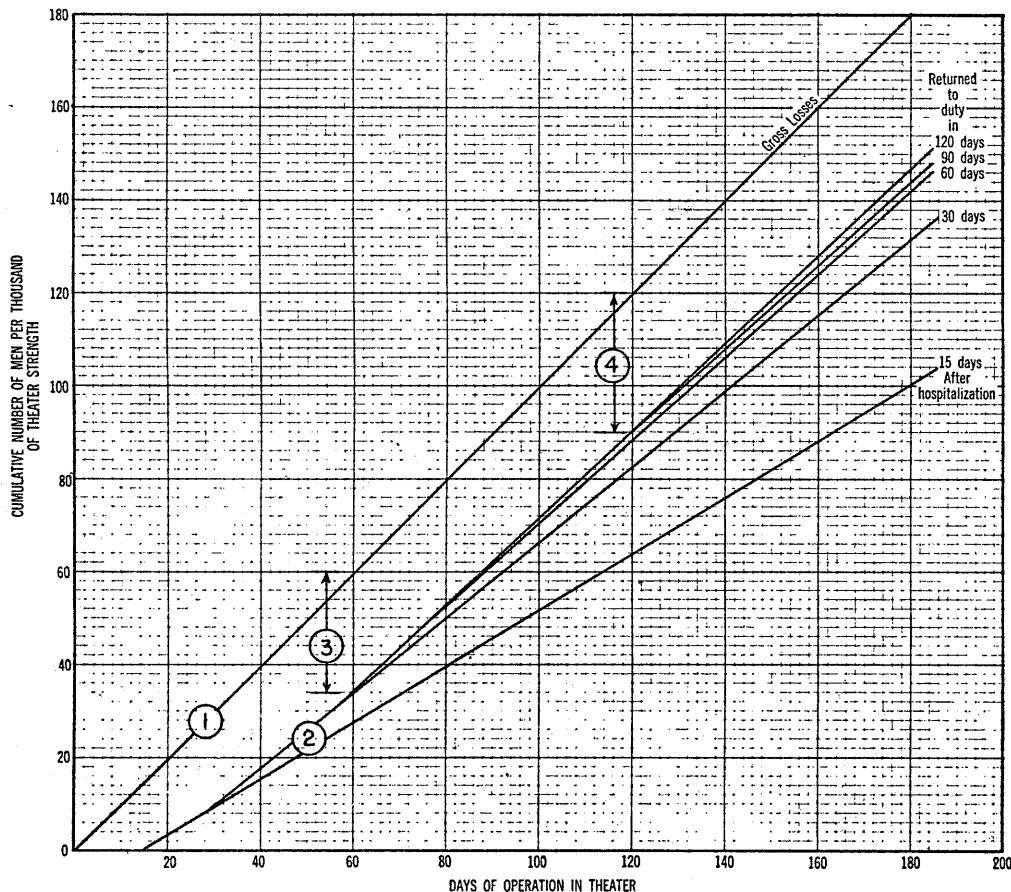
Under 90-day or 120-day evacuation policies:

28.6 percent of the battle casualties.

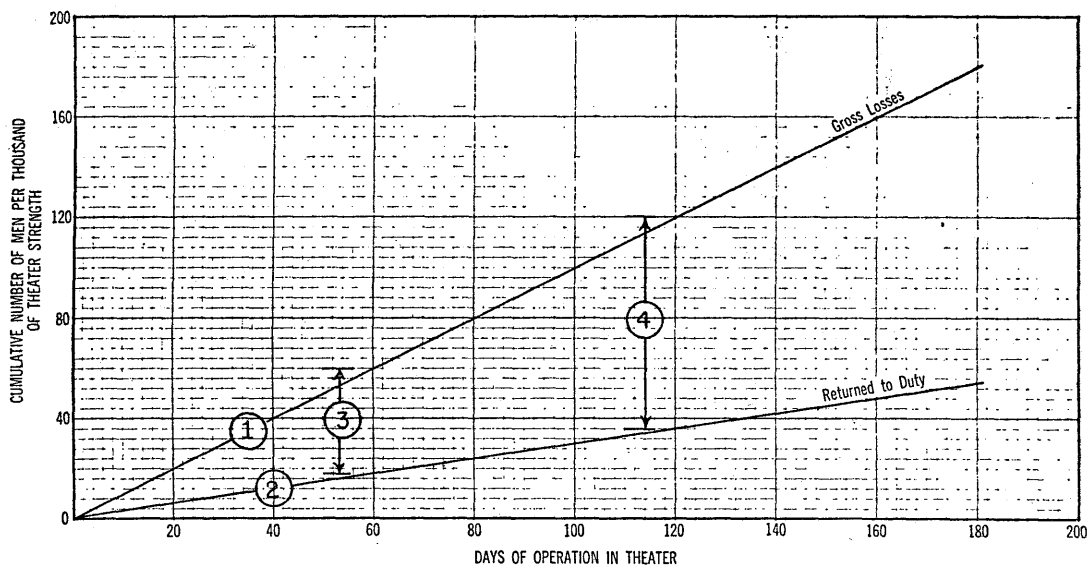
5.3 percent of the nonbattle casualties.

3. Graphs.

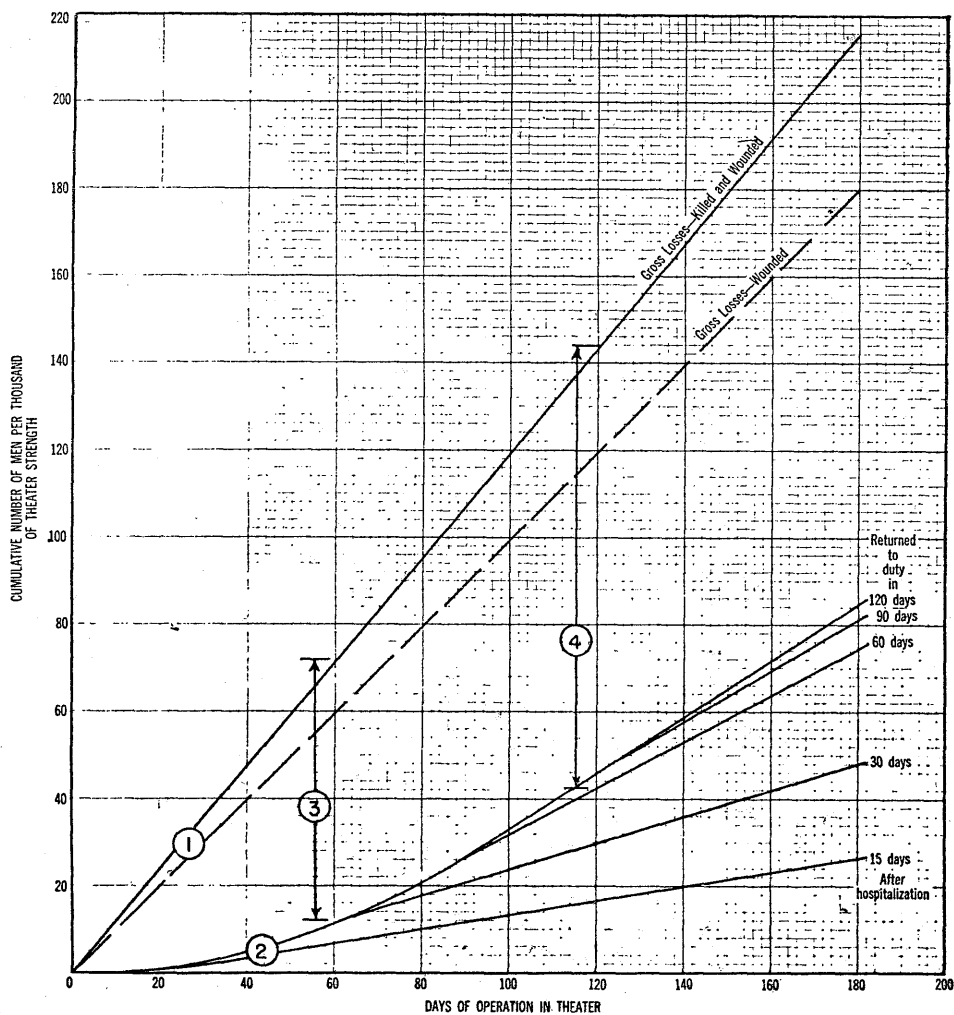
(a) *Disease and nonbattle injuries.*



(b) *Battle casualties—captured and missing.*



(c) *Battle casualties—other than captured and missing.*



(d) *T* factors for monthly net losses. Factors contained in 1, 2, 3, and 4 below were determined by measuring the length or ordinate between the gross line and the returns-to-duty line corresponding to the evacuation policy considered (30-, 60-, 90-, and 120-day evacuation policy) at 30-day intervals. Thus, measurement ③ on the graphs in (c)3 above is the source of the factors in the following tables, column 3; and measurement ④ is the source of the factors in 3 below, column 5. (Slight

variations between those figures taken from the graphs and those given in the table are due to the fact that figures in the table were based upon more complete data giving the percentage returned to duty within the theater from hospitals at 5-day intervals rather than 15-day intervals as given in (c)2(a) above.) (For fractional periods of a month, use the proportional part of the monthly factor; thus, for 10 days use 10/30 of the 30-day factor.)

Cumulative ¹								Monthly ²							
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	Type of loss-----	30 days	60 days	90 days	120 days	150 days	180 days	360 days	1- 30 days	30- 60 days	60- 90 days	90- 120 days	120- 150 days	150- 180 days	330- 360 days
1. 120-day evacuation policy.															
2	Disease and nonbattle injuries ³ ---	15.2	21.8	25.6	28.7	31.8	34.9	53.5	15.2	6.6	3.8	3.1	3.1	3.1	3.1
3	Battle casualties:														
	a. Captured and missing-----	21.0	42.0	63.0	84.0	105.0	126.0	252.0	21.0	21.0	21.0	21.0	21.0	21.0	21.0
	b. Other battle casualties ⁴ -----	30.3	56.0	76.8	95.2	113.0	130.8	237.6	30.3	25.7	20.8	18.4	17.8	17.8	17.8
2. 90-day evacuation policy.															
2	Disease and nonbattle injuries-----	15.2	21.8	25.6	28.8	32.0	35.2	54.4	15.2	6.6	3.8	3.2	3.2	3.2	3.2
3	Battle casualties:														
	a. Captured and missing-----	21.0	42.0	63.0	84.0	105.0	126.0	252.0	21.0	21.0	21.0	21.0	21.0	21.0	21.0
	b. Other battle casualties ⁴ -----	30.3	56.0	76.8	96.0	115.2	134.4	249.6	30.3	25.7	20.8	19.2	19.2	19.2	19.2
3. 60-day evacuation policy.															
2	Disease and nonbattle injuries ³ ----	15.2	21.8	25.6	29.4	33.2	37.0	59.8	15.2	6.6	3.8	3.8	3.8	3.8	3.8
3	Battle casualties:														
	a. Captured and missing-----	21.0	42.0	63.0	84.0	105.0	126.0	252.0	21.0	21.0	21.0	21.0	21.0	21.0	21.0
	b. Other battle casualties ⁴ -----	30.3	56.2	78.0	99.8	121.6	143.4	274.2	30.3	25.9	21.8	21.8	21.8	21.8	21.8
4. 30-day evacuation policy.															
2	Disease and nonbattle injuries ³ ----	15.2	21.8	28.4	35.0	41.6	48.2	87.8	15.2	6.6	6.6	6.6	6.6	6.6	6.6
3	Battle casualties:														
	a. Captured and missing-----	21.0	42.0	63.0	84.0	105.0	126.0	252.0	21.0	21.0	21.0	21.0	21.0	21.0	21.0
	b. Other battle casualties ⁴ -----	30.3	58.2	86.1	114.0	144.9	169.8	337.2	30.3	27.9	27.9	27.9	27.9	27.9	27.9

¹ The factors for this section of the table are derived from the graphs in (c)3 above by subtracting the ordinate of cumulative returns to duty line for each recovery period (30-, 60-, 90-, 120-day evacuation policy) at 30-day intervals from the corresponding ordinate of the cumulative gross line at the same intervals.

² The tabular values for this section of the table are derived from the cumulative net loss factors by subtracting the cumulative net loss factor at the end of each period from the cumulative net loss factor at the end of the next period.

³ This category includes hospital cases, deaths, and admissions sent to the zone of interior.

⁴ This category includes hospital cases, killed in action, died in hospital, and admission sent to the zone of interior.

(e) *T* factors for monthly returns to duty. Factors contained in 1, 2, 3, and 4 below were read directly from the graphs in (c)3 above. (For

fractional periods of a month, use the proportional part of the monthly factor; thus, for 10 days use 10/30 of the 30-day factor.)

Cumulative ¹									Monthly ²						
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	Type of loss-----	30 days	60 days	90 days	120 days	150 days	180 days	360 days	1- 30 days	30- 60 days	60- 90 days	90- 120 days	120- 150 days	150- 180 days	330- 360 days

1. 120-day evacuation policy.

2	Disease and nonbattle injuries----	14.8	38.2	64.4	91.3	118.2	145.1	306.5	14.8	23.4	26.2	26.9	26.9	26.9	26.9
3	Battle casualties:														
	a. Captured and missing-----	9.0	18.0	27.0	36.0	45.0	54.0	108.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	b. Other battle casualties-----	5.7	16.0	31.2	48.8	67.0	85.2	194.4	5.7	10.3	15.2	17.6	18.2	18.2	18.2

2. 90-day evacuation policy.

2	Disease and nonbattle injuries----	14.8	38.2	64.4	91.2	118.0	144.8	305.6	14.8	23.4	26.2	26.8	26.8	26.8	26.8
3	Battle casualties:														
	a. Captured and missing-----	9.0	18.0	27.0	36.0	45.0	54.0	108.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	b. Other battle casualties-----	5.7	16.0	31.2	48.0	64.8	81.6	182.4	5.7	10.3	15.2	16.8	16.8	16.8	16.8

3. 60-day evacuation policy.

2	Disease and nonbattle injuries----	14.8	38.2	64.4	90.6	116.8	143.0	300.2	14.8	23.4	26.2	26.2	26.2	26.2	26.2
3	Battle casualties:														
	a. Captured and missing-----	9.0	18.0	27.0	36.0	45.0	54.0	108.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	b. Other battle casualties-----	5.7	15.8	30.0	44.2	58.4	72.6	157.8	5.7	10.1	14.2	14.2	14.2	14.2	14.2

4. 30-day evacuation policy.

2	Disease and nonbattle injuries----	14.8	38.2	61.6	85.9	108.4	131.8	155.2	14.8	23.4	23.4	23.4	23.4	23.4	23.4
3	Battle casualties:														
	a. Captured and missing-----	9.0	18.0	27.0	36.0	45.0	54.0	108.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	b. Other battle casualties-----	5.7	13.8	21.9	30.0	38.1	46.2	95.0	5.7	8.1	8.1	8.1	8.1	8.1	8.1

¹ The cumulative factors for this table are derived by subtracting the cumulative net loss factor from (d) above from the cumulative gross factor for the same period from (b) above. They may be derived directly from the graphs in (c)3 above.

² The monthly factors for this table are derived by subtracting the cumulative returns to duty factor at the end of each period from the cumulative factor at the end of the next period.

(f) *T* factors for returns to duty within the theater of losses occurring in any given month. The factors for this table were derived from the monthly returns to duty factors

given in (e) above by subtracting from the monthly factor for each month the monthly factor for the preceding month.

	1	2	3	4	5	6
1	Losses occurring in any given month returned to duty in.	Same month.	1st following month.	2d following month.	3d following month.	4th following month.

1. 120-day evacuation policy.

2	Diseases and nonbattle injuries.....	14.8	8.6	2.8	0.7	0
3	Battle casualties:					
	a. Captured and missing.....	9.0	0.	0.	0.	0.
	b. Other battle casualties.....	5.7	4.6	4.9	2.4	0.6

2. 90-day evacuation policy.

2	Disease and nonbattle injuries.....	14.8	8.6	2.8	0.6	0
3	Battle casualties:					
	a. Captured and missing.....	9.0	0	0	0	0
	b. Other battle casualties.....	5.7	4.6	4.9	1.6	0

3. 60-day evacuation policy.

2	Disease and nonbattle injuries.....	14.8	8.6	2.8	0	0
3	Battle casualties:					
	a. Captured and missing.....	9.0	0	0	0	0
	b. Other battle casualties.....	5.7	4.4	4.1	0	0

4. 30-day evacuation policy.

2	Disease and nonbattle injuries.....	14.8	8.6	0	0	0
3	Battle casualties:					
	a. Captured and missing.....	9.0	0	0	0	0
	b. Other battle casualties.....	5.7	2.4	0	0	0

(4) *R* (conversion) factors.

(a) The tables given in (3) (d), (e), and (f) above were computed on assumed loss rates given in (3) (a) above and on World War II return-to-duty rates given in (3) (c) 2 above. These tables must be modified to reflect the actual average daily loss experience of each theater. Thus, in a particular theater, the hospital admission rates for disease

and nonbattle injuries or for wounds may be higher or lower than the assumed rates. The conversion factor *R* is the ratio of the theater actual daily loss rates to the assumed loss rates.

(b) *Example:* Assume an actual theater of operations in which the average disease and nonbattle injury rate is 0.8 men per 1,000 per month, the captured and missing loss rate

is 1.7 men per 1,000 per month, and other battle casualties average 1.5 men per 1,000 per month. Then—

$$R \text{ for disease and nonbattle injuries} = \frac{.8}{1} \text{ or } .8$$

$$R \text{ for captured and missing} = \frac{1.7}{1} \text{ or } 1.7$$

$$R \text{ for other battle casualties} = \frac{1.5}{1.2} \text{ or } 1.25$$

- (c) The following table is provided for planning purposes and for use in training and other situations in which actual theater experience is not available. The table is based upon averages of United States Army experience in all theaters in World War II.

	1	1
	Type of loss	R factors
2	Disease and nonbattle injuries.....	1.4
3	Battle casualties:	
	a. Captured and missing.....	0.16
	b. Other battle casualties.....	1.0

- (5) *S factors.* As stated in (2)(a) above, *S factors* are always theater army strength in thousands. The most accurate figures available should be used. When actual assigned strengths are known or can be accurately predicted, they should be used. When actual strengths are not known or cannot be predicted, then authorized strengths should be used.

- (6) *Example—estimation of losses by formula ($R \times T \times S$).* Given a theater army strength of 2,000,000, a 60-day evacuation policy, and theater daily loss rates as shown in (4)(c) above, make the following theater estimates for losses occurring during the next 60 days.

- (a) *Gross losses* ((3)(b), (4)(c), and (5) above).

1. *Cumulative for 60 days.*

(a) Disease and nonbattle injuries $(1.4 \times 60 \times 2,000)$ ----- 168,000

- (b) Battle casualties:

(1) Captured and missing $(0.16 \times 60 \times 2,000)$ ----- 19,200

(2) Other battle casualties $(1.0 \times 72 \times 2,000)$ ----- 144,000

(c) Total ----- 331,200

2. *First 30 days.*

(a) Disease and nonbattle injuries $(1.4 \times 30 \times 2,000)$ ----- 84,000

- (b) Battle casualties:

(1) Captured and missing $(0.16 \times 30 \times 2,000)$ ----- 9,600

(2) Other battle casualties $(1.0 \times 36 \times 2,000)$ ----- 72,000

(c) Total ----- 165,600

3. *Second 30 days.* (Same as 2 above.) ----- 165,000

- (b) *Returns to duty within the theater* ((3)(e), (4)(c), and (5) above).

1. *Cumulative for 60 days.*

(a) Disease and nonbattle injuries $(1.4 \times 38.2 \times 2,000)$ ----- 106,960

- (b) Battle casualties:

(1) Captured and missing $(0.16 \times 18 \times 2,000)$ ----- 5,760

(2) Other battle casualties $(1.0 \times 15.8 \times 2,000)$ ----- 31,600

(c) Total ----- 144,320

2. *First 30 days.*

(a) Disease and nonbattle injuries $(1.4 \times 14.8 \times 2,000)$ ----- 41,440

- (b) Battle casualties:

(1) Captured and missing $(0.16 \times 9 \times 2,000)$ ----- 2,880

(2) Other battle casualties $(1.0 \times 5.7 \times 2,000)$ ----- 11,400

(c) Total ----- 55,720

3. Second 30 days.

(a) Disease and nonbattle injuries ($1.4 \times 23.4 \times 2,000$)	65,520
(b) Battle casualties:	
(1) Captured and missing ($0.16 \times 9 \times 2,000$)	2,880
(2) Other battle casualties ($1.0 \times 10.1 \times 2,000$)	20,200
(c) Total	88,600
(c) Net losses ((3) (d), (4) (c), and (5) above).	

1. Cumulative for 60 days.

(a) Disease and nonbattle injuries ($1.4 \times 21.8 \times 2,000$)	61,040
(b) Battle casualties:	
(1) Captured and missing ($0.16 \times 42 \times 2,000$)	13,440
(2) Other battle casualties ($1.0 \times 56.2 \times 2,000$)	112,400
(c) Total	186,880

2. First 30 days.

(a) Disease and nonbattle injuries ($1.4 \times 15.2 \times 2,000$)	42,560
(b) Battle casualties:	
(1) Captured and missing ($0.16 \times 21 \times 2,000$)	6,720
(2) Other battle casualties ($1.0 \times 30.3 \times 2,000$)	60,600
(c) Total	109,880

3. Second 30 days.

(a) Disease and nonbattle injuries ($1.4 \times 6.6 \times 2,000$)	18,480
(b) Battle casualties:	
(1) Captured and missing ($0.16 \times 21 \times 2,000$)	6,720
(2) Other battle casualties ($1.0 \times 25.9 \times 2,000$)	51,800
(c) Total	77,000

Section III. PRISONER OF WAR CAPTURE RATES

2.8. General

In order that the necessary arrangements may be made for the reception, care, and disposition of prisoners of war, it will be necessary to estimate the number of prisoners that probably will be captured over a period of time or for a specific operation. Factors to be considered in preparing such an estimate include the following:

- Enemy morale.
- Avenues of withdrawal open to the enemy.
- Ability of friendly forces to encircle or cut off enemy units.
- Type of warfare in which forces are engaged; that is, position warfare, war of movement, etc.
- Relative strength of opposing forces.
- Intensity and effectiveness of friendly psychological warfare.
- Effectiveness of ideological indoctrination of enemy troops.

2.9. Division and Corps Estimate

a. Equal Force Estimates. When the opposing forces are approximately equal in number, the average number of prisoners expected to be taken can be estimated by using the factors listed below.

Troops	Percentage per month of strength
Armored divisions	.8
Infantry divisions	1.35
Corps and army nondivisional units	negligible

b. Unequal Force Estimates. For estimates by divisions (or task forces) and corps, the following figures are averages, based on experiences of some United States divisions against veteran troops in World War II. In these instances, United States forces were numerically superior by about 2 to 1—

By a division in attack of a defensive position	50 per day.
By a division in attack of a defensive position preceded by night approach and with complete surprise obtained	700 per day.

By an armored task force in an encirclement operation ----- 1,000 per day.
 By a division in defense of a position against an unsuccessful attack ----- 300 per day.
 (Expressed as an average number of prisoners per division per day.) ----- 47 per day.

2.10. Theater Estimates

a. For overall estimates on a theater level under nonatomic conditions, the factors in the following table may be used.

Prisoner of War Capture Rates¹

1	Organization	2 Prisoners of war per month			
		Defense	Offense	Capitulation	
				First month	Succeeding month
2	Inf div (ROCID)-----	185	2,850	6,000	30,000
3	Inf div (TOE 7C)-----	236	3,600		
4	Armd div (ROCAD)---	117	3,600	6,000	30,000
5	Armd div (TOE 17R)---	118	3,600		
6	Abn div (ROTAD)---	155	2,550	6,000	30,000
7	Abn div (TOE 57C)---	236	3,600		

¹ Prisoner of war capture rates do not include civilian internees.

b. Since prisoners are not captured at a uniform rate, special preparations must be made for the reception of unusual numbers when theater plans contemplate decisive action, such as cutting routes of withdrawal or driving the enemy against an obstacle.

c. An accurate method of estimating prisoner of war capture rates under conditions of nuclear or chemical, biological, and radiological warfare has not been determined. However, using target analysis methods, enemy casualties can be estimated and assumptions made of the number of enemy casualties remaining in the area which will be subject to capture in the exploitation phase.

Section IV. PERSONNEL SERVICES

2.11. General

The data presented in paragraphs 2.12 and 2.13 are intended for planning purposes only and do not represent doctrine. The figures have been compiled from the experience of the European Theater of Operations in World War II and the Korean Conflict by averaging the experience of several units over several periods of time. The figures are based on the needs per month of 10,000 troops.

2.12. Decorations

	<i>Approximate average</i>
Distinguished-Service Cross-----	9
Distinguished-Service Medal-----	1
Silver Star-----	103
Legion of Merit-----	20
Distinguished-Flying Cross-----	6
Soldier's Medal-----	7
Bronze Star-----	565
Heroism-----	(270)
Meritorious Achievement-----	(295)
Air Medal-----	85
Commendation Ribbon-----	485
Purple Heart-----	1,175

2.13. Mail

	Pieces	Weight in pounds	M/tons of shipping space
<i>a. Wartime.</i>			
(1) <i>Surface.</i>			
(a) Incoming (to the theater)— Third- and fourth-class mail-----	26,650	49,754	155.481
(b) Outgoing— Third- and fourth-class mail-----	1,436	2,675	8.328
(2) <i>Air.</i>			
(a) Incoming— Airmail-----	265,083	6,165	17.614
First-class mail-----	97,450	2,256	6.429
(b) Outgoing— Airmail-----	205,549	4,757	13.591
First-class mail-----	54,973	1,270	3.629
<i>b. Peacetime.</i>			
(1) <i>Surface.</i>			
(a) Incoming (to the theater)— First-class mail-----	199,010	5,763	16.466
Other-----	10,910	43,453	135.791
(b) Outgoing— First-class mail-----	52,250	1,075	3.071
Other-----	12,480	47,926	149.769
(2) <i>Air.</i>			
(a) Incoming— Airmail-----	148,183	4,306	12.303
First-class mail-----	82,830	3,765	10.757
Parcel post-----	870	3,187	9.959
(b) Outgoing— Airmail-----	261,018	5,118	14.623
First-class mail-----	47,234	1,243	3.551
Parcel post-----	975	3,656	11.425

Section V. INTERNAL ARRANGEMENT OF HEADQUARTERS

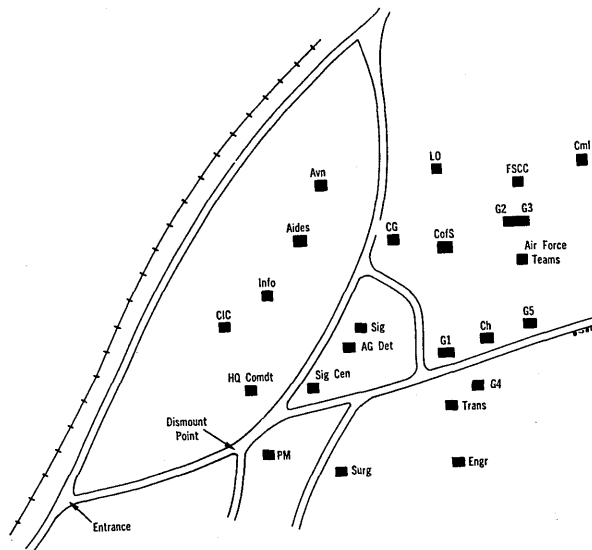
2.14. General

The following diagrams indicate schematic arrangements for army, corps, and division headquarters. The echelons of army, corps, and

division headquarters may be located in buildings. The diagrams which are shown for these headquarters suggest a layout to be followed when they operate under tentage.

2.15. Division Headquarters (Schematic)

a. Main Command Post.



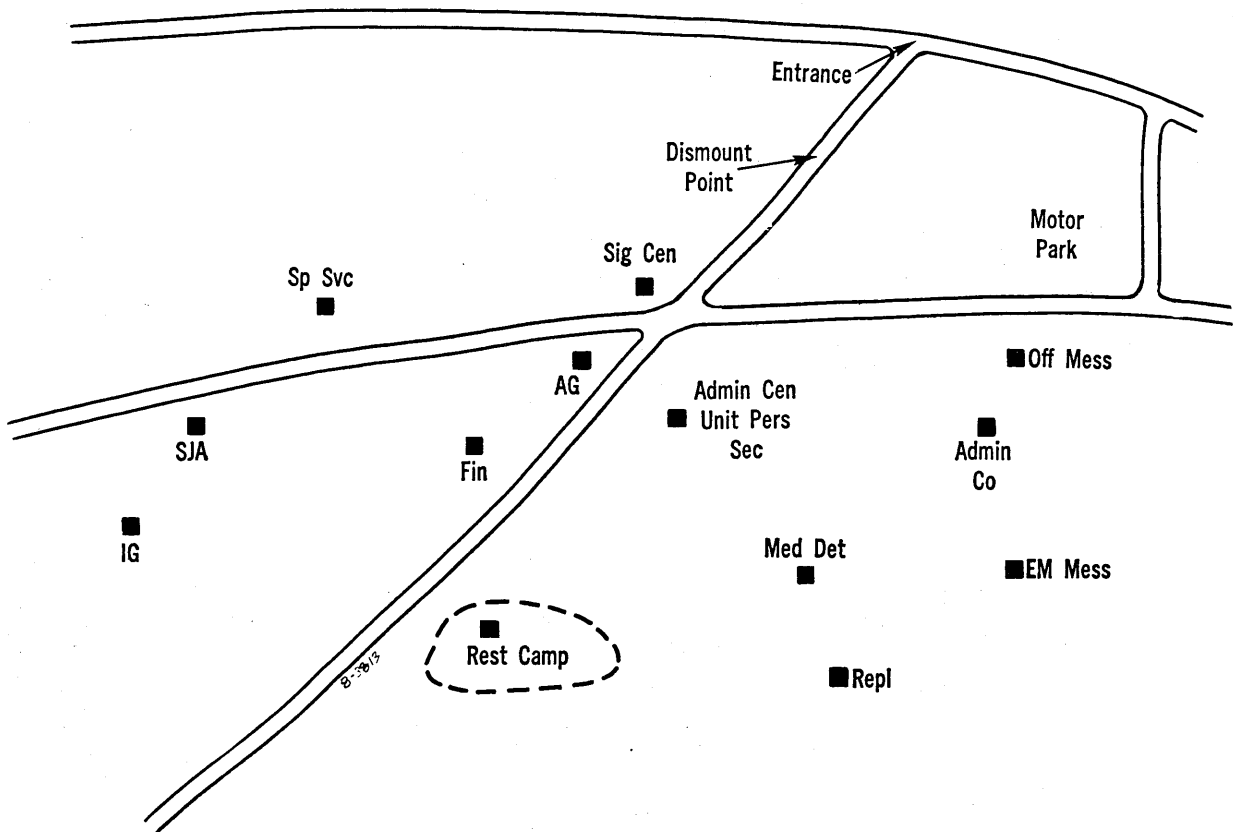
Note 1. In the infantry division, the brigade command post is established by the brigade headquarters section under the command of the assistant division commander. It normally operates in one echelon in the vicinity of one of the area communication centers and at a sufficient distance from the main command post to preclude destruction of both headquarters by a single weapon.

Note 2. In the airborne division, modifications will be effected because of organization and mission.

Note 3. While not part of the main command post, sufficient area also must be provided for a motor park, messes, elements of headquarters company, the military police detachment, and helicopter landing zone and/or airstrip.

Note 4. Elements of the Main Command Post may be located in a Forward Command Post.

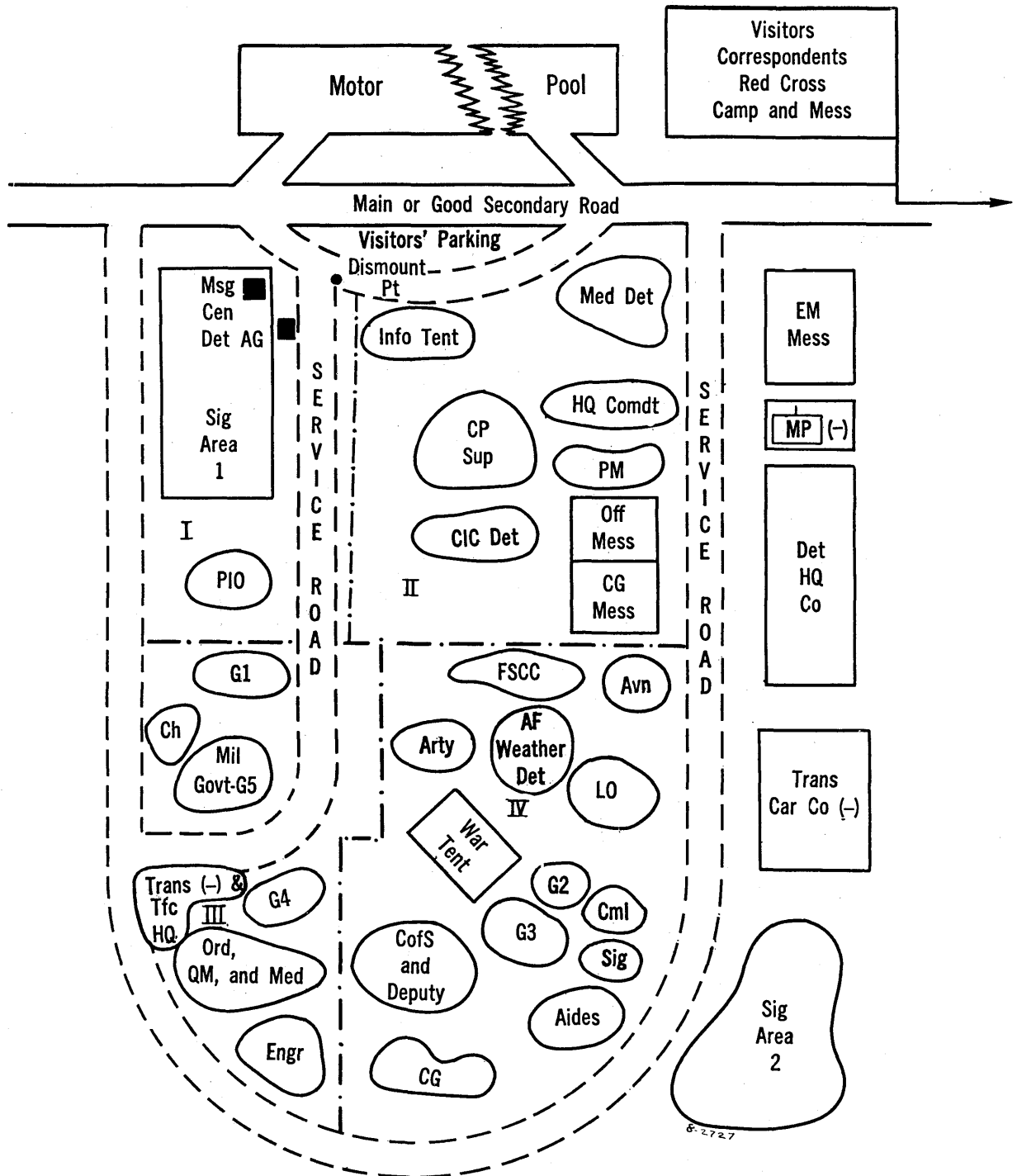
b. *Rear Command Post* (not to scale).



Note: 1. Rear command post may be located outside the division area.
 2. Rest camp may be located outside the rear command post and/or division area.

2.16. Corps Headquarters

a. Main Command Post (not to scale).

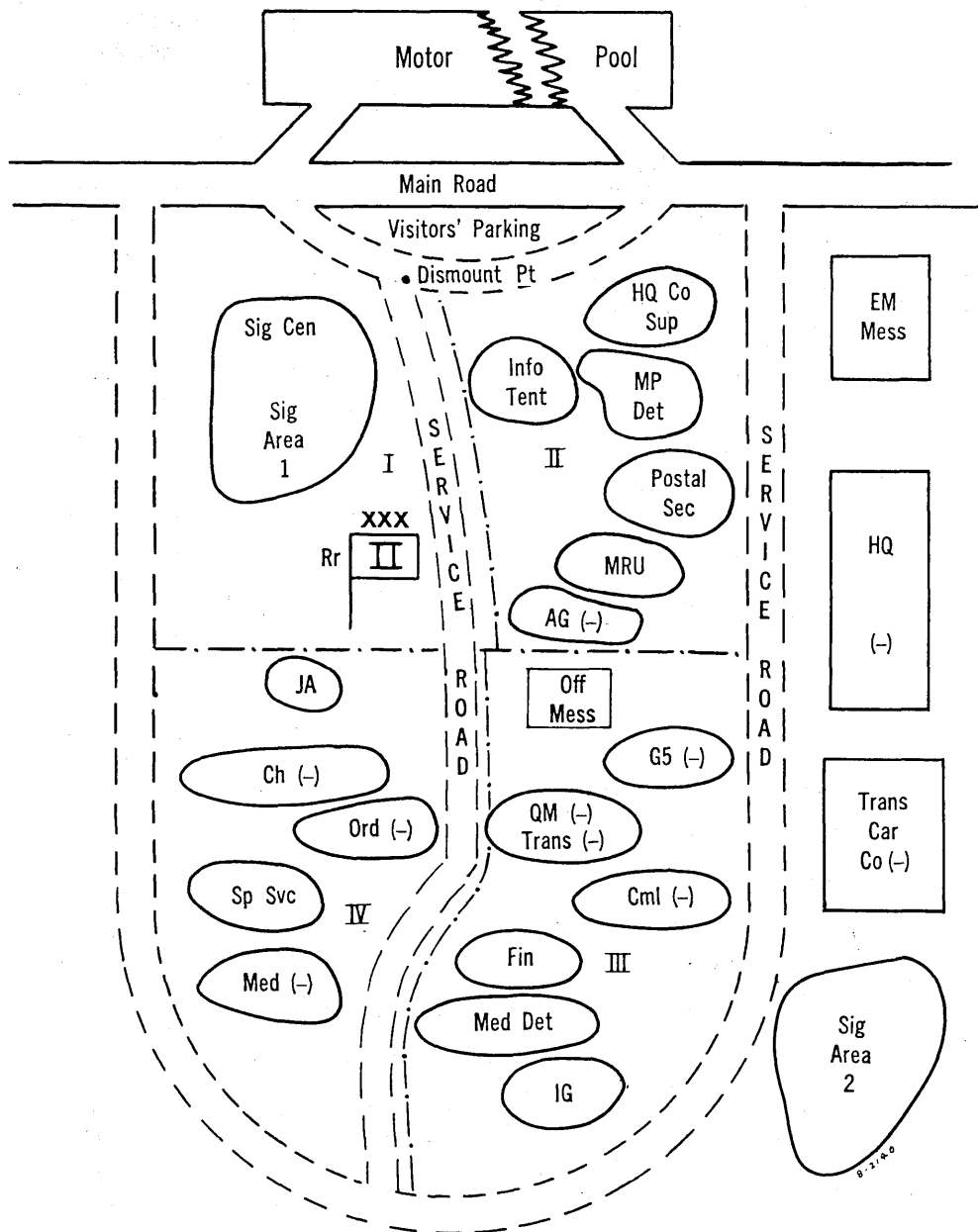


Relative Locations of Sections at Corps Main Command Post

Note 1. Notice that the total area occupied is divided into four areas. Various sections should endeavor to retain their relative positions within their respective areas.

Note 2. Elements of Main Command Post may be located in a Forward Command Post.

b. *Rear Command Post* (not to scale).

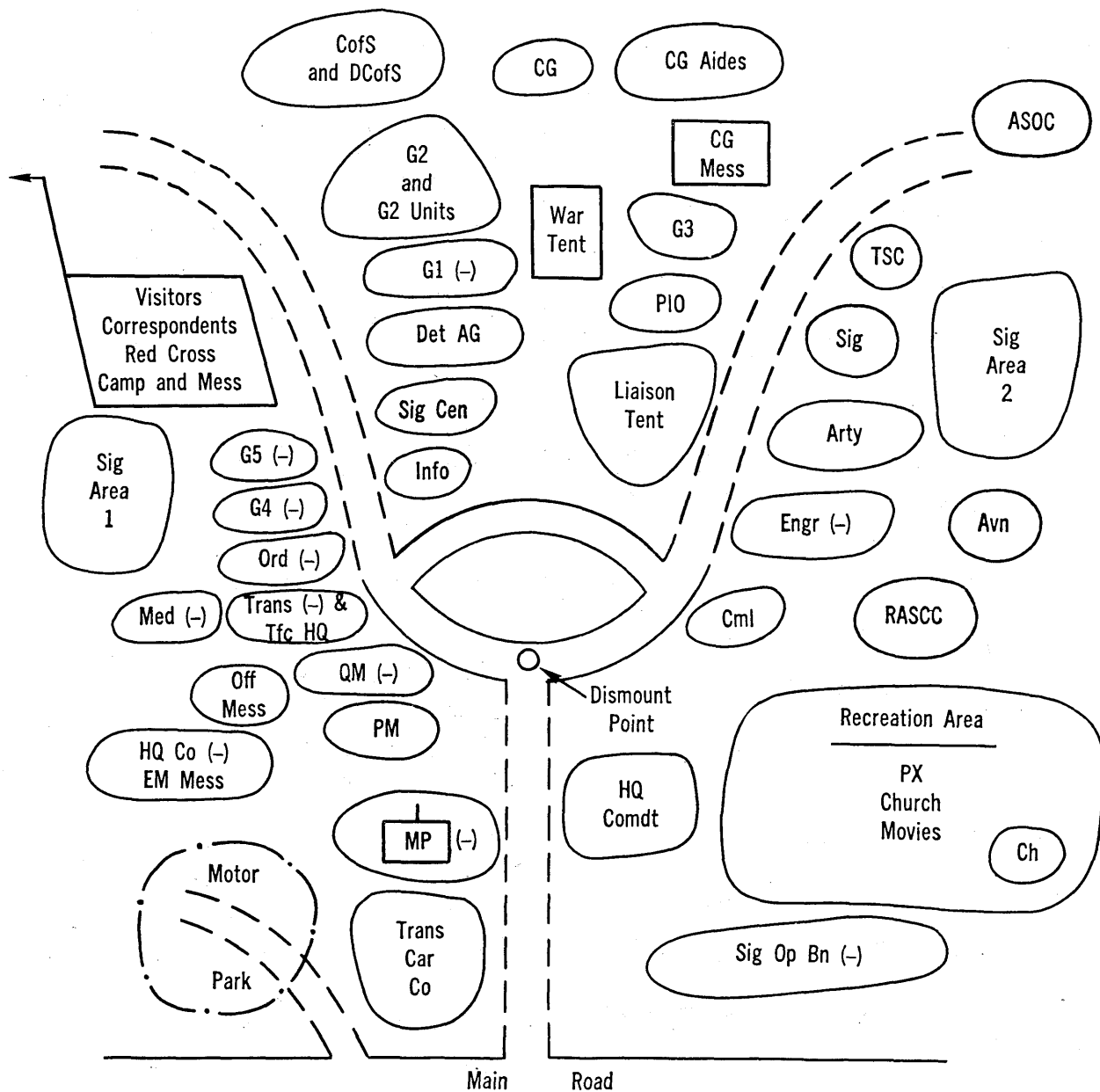


Relative Locations of Sections at Corps Rear Command Post

Note. Notice that the total area is divided into four areas. Various sections should endeavor to retain their relative positions within their respective areas.

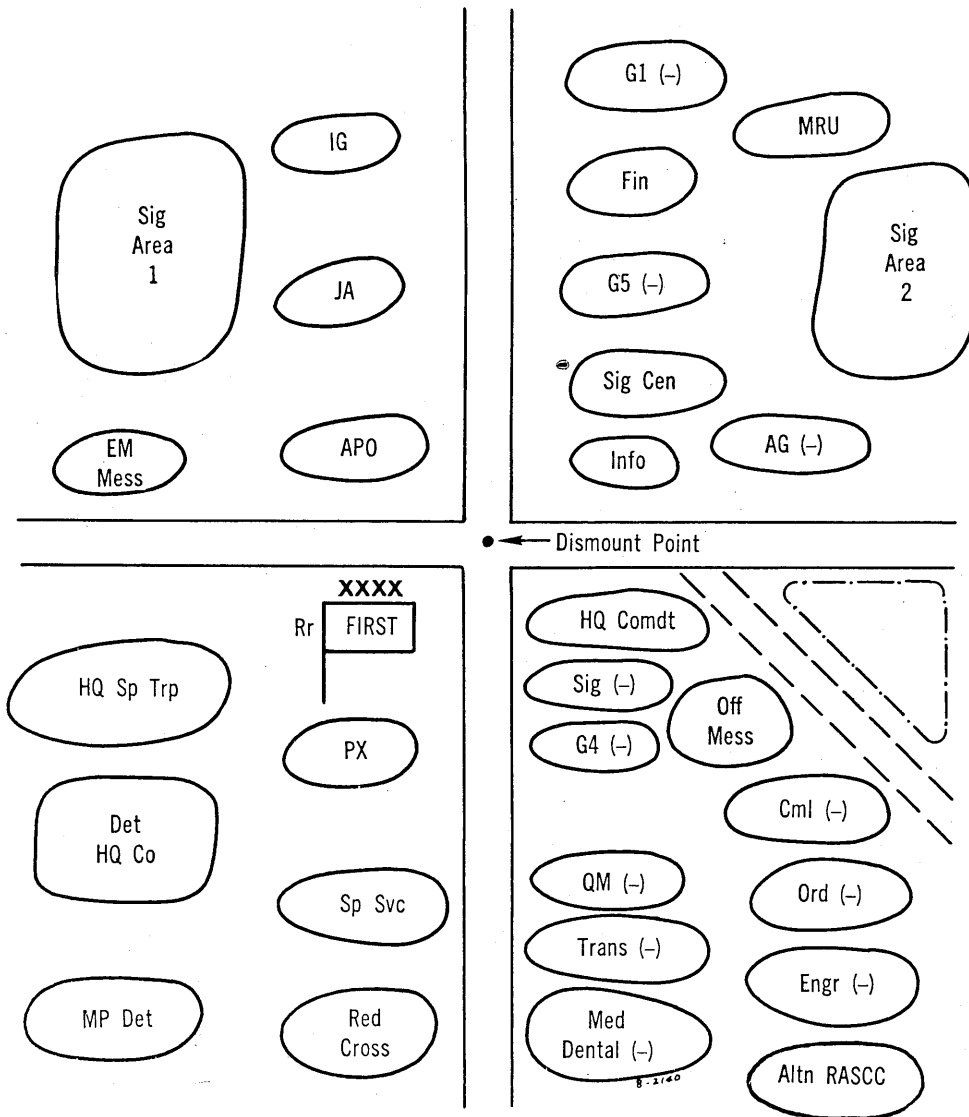
2.17. Army Headquarters

a. Main Command Post (not to scale).



Note. Elements of the Main Command Post may be located in a Forward Command Post.

b. Rear Command Post (not to scale).



CHAPTER 3

INTELLIGENCE

Section I. GENERAL

3.1. Intelligence—Planning Data

a. *Intelligence Troop Units.* Special intelligence units and detachments are presented in paragraph 4.2k.

b. *Planning Data.* The mapping process requires a long lead-time from initiation of requirements until the reproduced copies of the final maps are made available to the troops requiring them. The following section provides

basic data on responsibilities for mapping, types of maps, factors for estimation of various logistical problems in connection with map reproduction, determination of requirements, supply, and distribution. This information is for general planning only, and the specific problem of providing map support for an operation should be coordinated with the engineer of the planning echelon.

Section II. MAPS

3.2. Responsibility for Maps and Mapping

Agency		Duties
Zone of interior	Theater of operations	
Joint Chiefs of Staff (Joint Intelligence Committee).	Theater of operations, unified command (J2).	Coordinate the joint mapping and charting activities within the Department of Defense (theater of operations). Determine requirements and prepare plans of joint interest (necessary to support the mission assigned by the Joint Chiefs of Staff) covering the production and distribution of the various series of maps and charts required for military operations and training, and establish project priorities for the separate elements of such plans. Maintain plans and project priorities on a current basis and revise these plans and priorities in keeping with new developments. Provide guidance on operating schedules for the implementation of the operating plans. Assign responsibilities and expand or eliminate activities of the photographic, mapping, and charting agencies of the Department of Defense (theater of operations) when such measures are indicated and are not in conflict with existing laws and regulations. The theater of operations executes such specific mapping and charting projects as may be assigned by the Joint Chiefs of Staff. The theater of operations advises the Joint Chiefs of Staff as to map and photo requirements necessary for performance of assigned missions which cannot be met by allotted resources.
Department of the Army, Assistant Chief of Staff, Intelligence.	Theater army headquarters (G2).	Responsible for the mapping activities of the Department of Defense and charting activities of the Department of the Army (Army forces in the theater of operations) and directs and coordinates these activities. Determines Department of the Army (Army forces in the theater of operations) requirements and priorities for map and chart coverage pertinent to planning and operations, and takes action to meet these requirements. Responsible for the preparation, reproduction, supply, storage, and distribution of maps, charts, map manuscripts, and related mapping material; the provision of ground control support for artillery and missile fires; and the performance of the final evaluation of all required mapping photography.

Agency		Duties
Zone of interior	Theater of operations	
Corps of Engineers.	Theater army engineer.	Under supervision of G2, prepares plans and policies pertaining to topographic surveys and maps, including all technical aspects of mapping, together with map reproduction, supply, and distribution. Operation of the Army Map Service. Coordination with joint, Allied, and civilian mapping agencies to avoid duplication of effort and to insure the maximum uniformity of maps reproduced, as directed by G2.
Signal Corps.	Theater army signal officer.	Quantity reproduction of airphotos for use throughout the Army.
Air Force.	Theater air force.	The accomplishment of aerial photography. Aerial photography for military mapping will be accomplished in accordance with specifications and priorities prepared by the Corps of Engineers, or theater army engineer, and approved by the Assistant Chief of Staff, Intelligence, Department of the Army, or theater army G2. Aerial photography for aeronautical charting will be accomplished in accordance with specifications and priorities prepared by the Chief of Staff, United States Air Force. The preparation of specifications pertaining to aeronautical charts, the procurement, compilation, reproduction, maintenance, supply, and distribution of aeronautical charts and related publications, and the establishment of geodetic control required for aeronautical charting. The development of improved technical processes and equipment used in all aerial photography and of special equipment and methods required by the United States Air Force for the production of aeronautical charts. In furtherance of the above responsibilities, the Chief of Staff, Air Force, will establish facilities to provide for aeronautical charts covering the world. Aerial photographic work to meet intelligence needs of combat troops.
G2 of divisions or larger units.	G2 of divisions or larger units.	Preparation of plans and policies and supervision of all activities concerning military topographic surveys and maps, including their acquisition, reproduction, and distribution.
S2 of battle groups, battalions, or similar units.	S2 of battle groups, battalions, or similar units.	Advance planning, in coordination with the S3, to insure timely acquisition and distribution of necessary maps.
Unit commander.	Unit commander.	Advance planning, which is necessary if the mapping situation is to keep ahead of the tactical situation. Good maps will seldom be on hand without special command effort.

3.3. Military Classification of Maps

a. Classification by Type.

- (1) *Topographic map.* A topographic map portrays the natural and man-made features of the earth's surface in measurable form, showing both their horizontal and their vertical positions. The vertical positions, or relief, are normally represented by contours. On maps showing relief the elevations are usually referred to a mean sea-level datum-plane.
- (2) *Planimetric map.* A planimetric map presents only the horizontal position for the detail plotted. It is distinguished from a topographic map by

the omission of relief in a measurable form.

- (3) *Photomap.* A photomap is a reproduction of an aerial photograph or a mosaic made from a series of aerial photographs, upon which arbitrary grid lines, marginal data, place names, route numbers, contours, important elevations, boundaries, approximate scale, and approximate direction may have been added. Photomaps are not usually contoured.
- (4) *Photomosaic.* Assembly of aerial photographs to form a composite picture.
- (5) *Relief map.*
 - (a) A map on which differences in ele-

vations are depicted by shading, tints, colors, etc.

- (b) A three-dimensional map produced by molding plaster, rubber, or other materials.
- (c) Plastic relief map, a three-dimensional map, usually topographic, molded in plastic. Because of the comparative speed and economy in production, this product has almost completely replaced other types of relief maps.
- (d) Terrain model, a three-dimensional representation of an area, usually at very large scale, showing cultural and terrain features realistically instead of by topographic symbols.
- (6) *Special map*. A special map is designed for a special purpose, such as trafficability maps or transportation maps.
- b. *Classification by Scale*.
 - (1) *Small-scale military maps* have scales of 1:600,000 or smaller.
 - (2) *Medium-scale military maps* have scales larger than 1:600,000 and smaller than 1:75,000.
 - (3) *Large-scale military maps* have scales of 1:75,000 or larger.
- c. *Classification by Military Use*.
 - (1) A *general map* has a scale smaller than 1:1,000,000. It is used for general planning purposes.
 - (2) A *strategic map* has a scale of 1:1,000,000. It is used for planning purposes, to include movement, concentration, and supply.
 - (3) A *strategic-tactical map* has a scale of 1:250,000. A map having a scale of 1:500,000 may serve as an alternate. It is used as a detailed planning map, as a graphic to illustrate briefings, as a base for medium-scale plastic relief maps, as a road map, and for phases of close air-ground support. When no larger scales are available, it is used as a tactical map and to assist field artillery in fire control.
 - (4) A *road map* has a scale of 1:250,000 or smaller. It is used for tactical and administrative troop movements. It gives the location of towns and roads

and distinguishes between the various types of roads, road surfaces, and road capacities. Under some conditions, a map at the scale of 1:250,000 will be used interchangeably as a strategic-tactical map and as a road map.

- (5) A *tactical map* has a scale of 1:50,000. It is used for tactical and administrative purposes. At times a map having a scale of 1:25,000 or 1:100,000 serves as an alternate. The tactical map is used commonly by all arms and services.
- (6) An *artillery map* has a scale of 1:25,000. It is used for directing artillery fire. A map at the scale of 1:50,000 may serve as an alternate.
- (7) A *photomap*, as defined in a(3) above, has a preferred scale of 1:25,000 and an alternate scale of 1:12,500. It is used for tactical and administrative purposes.
- (8) A *military city map* has a scale of 1:12,500 or larger. It is used to represent the road network of urban areas and to locate principal buildings and other prominent features that are of military importance and which can be plotted at this scale.

d. *Aeronautical charts* are produced and distributed by the Aeronautical Chart and Information Center, Department of the Air Force. Aeronautical charts are classified according to the use for which they are intended. Principal classifications, uses, and scales are as follows:

- (1) *Planning charts*. Planning charts are used for the planning of worldwide air routes, controlling strategic air movements, and developing the elements of a major air transportation system. Planning charts are published at scales of 1:5,000,000 or smaller.
- (2) *Long-range air navigation charts*. The long-range air navigation chart is used for celestial navigation and for dead reckoning navigation. It is published at scales of 1:1,000,000 to 1:5,000,000.
- (3) *Standard air navigation charts*. The standard air navigation chart is used for pilot orientation in accurate con-

tact flying. It covers land and water areas and shows aids and hazards to navigation. The standard air navigation chart is frequently called a pilotage chart and is published at scales of 1:250,000 to 1:1,000,000.

- (4) *Approach charts.* An approach chart may be used for the air phase of ground-air support and for contact flying in congested areas. It gives data that pertain to critical obstructions as well as other details that pertain to a desired direction of approach. It may also contain panoramic views and oblique perspectives. The approach chart is published as scales of 1:250,000 to 1:50,000 and larger.
- (5) *Target charts.* The target chart is used to designate a particular air target. This is a large-scale chart which contains schematic information that distinguishes assigned targets in a definite manner or a particular target in a general target area.

3.4. Requirements for Military Maps

a. *General.* To calculate quantities of maps required for an operation, the following must be determined:

- (1) The number of scales at which coverage is to be provided. Data are in *b* below.
- (2) The number of sheets of each map scale (that is, the area coverage required at each scale). Data are in *c* below.
- (3) The number of copies of each sheet required for initial issue. Data are in *d* below.
- (4) The number of copies of each sheet required for replenishment issues. Data are in *e* below.
- (5) Total copies of each scale required for each operation equals sheets $\times$ copies (initial plus replenishment).
- (6) Tonnage of maps and quantities required for large units are shown in *g* below.

b. Map Scales Normally Provided in Bulk at Each Echelon.

	1	2	3	4	5	6	7
1	Unit	Theater HQ	Army Gp HQ and Army Gp Trp	Army HQ and Army Trp	Corps HQ and Corps Trp	Armd Div	Inf and Abn Div
2	Small scale:						
	1:5,000,000	x	x	x			
	1:1,000,000	x	x	x			
3	Medium scale:						
	1:500,000				x		
	1:250,000					x	x
	1:100,000			x	x	x	x
4	Large scale:						
	1:50,000				x	x	x
	1:25,000						x
5	Aeronautical charts	x	x	x	x	x	x
6	Road maps	x	x	x	x	x	x

c. *Number of Sheets at Each Map Scale* (i.e., the area coverage required at each scale).

- (1) *Army area coverage.* Number of different map sheets required per army on an average front of 50 miles, assuming a rate of advance of 5 miles per day and a 21-day reserve:

Scale	No. of sheets
1:5,000,000	1
1:1,000,000	4
1:500,000	8
1:250,000	8
1:100,000	20
1:50,000	54
1:25,000 (topographic and photomap)	162

- (2) *Division and smaller unit area coverage* (i.e., number of sheets required to cover an average area of operations) :

	1	2	3	4	5	6	7
1	Unit	1 : 1,000,000	1 : 500,000	1 : 250,000	1 : 100,000	1 : 50,000	1 : 25,000
2	Div HQ-----	1	5	8	10	12	20
3	BG HQ-----	1	1	1	8	8	16
4	Bn HQ-----	0	0	1	6	6	10
5	Off-----	0	0	1	1	2	3
6	Veh-----	0	0	1	0	0	0
7	Airplane-----	1	1	0	0	1	0

- (3) When an series is missing, the number of individual sheets of the next major series is increased to provide equivalent area coverage; for example, in the absence of a 1:100,000 scale series, approximately 40 sheets of the 1:50,000 series are required by division headquarters.

d. Copies of Each Sheet Required for Initial Issue.

- (1) *Guides for estimating quantities.*

(a) *General.* Small- and medium-scale maps and air charts are issued in small quantities to headquarters only. The basis of issue is the unit headquarters, and quantities vary in proportion to the size of the unit. Basic figures are given in table showing headquarters allowances ((g) below).

- (b) *Large-scale maps.*

1. *General.* Bases used in computing allowances of large-scale maps vary with the type of the unit. The company is the basic unit for computing large-scale map requirements. Headquarters and service companies use the same basis as other companies. Allowances for unit headquarters are given in (g) below. In addition, an allowance of one copy per organic Army aircraft is made.

2. *Infantry and combat engineer units.* Map allowances for infantry and combat engineer units are based on the number of platoons at two copies per platoon.

3. *Artillery units.* Allowances for headquarters and service batt-

ies are the same as for infantry units. Allowances for firing batteries are based on the number of sections at one per section plus two per forward observer and liaison officer.

4. *Armored units.* Large-scale map allowances for armored units are computed on the same basis as infantry units plus an additional allowance based on the number of tanks, carriages, and armored personnel carriers, with armament, at one per two vehicles.

5. *Airborne units.* Allowances for airborne units are the same as for equivalent ground troops. When engaged in airborne operations, allowances will be twice that of equivalent ground troops.

6. *Other units.* Map requirements for other units are based on officer strength at one per officer and one per reconnaissance noncommissioned officer.

(c) *Road maps.* Road maps are issued one per vehicle.

(d) *Air charts.* In addition to the headquarters allowances, air charts are issued on a basis of two per organic Army aircraft.

(e) *Photomaps.* Photomaps are issued as substitutes for large-scale maps when the latter are not available. When necessary as supplements to topographic maps, photomaps are issued in quantities not exceeding those authorized for topographic maps.

(f) *Hydrographic charts.* Hydrographic

charts are issued to units and headquarters as required by the situation and the mission of the unit.

(g) *Headquarters.* In addition to the

guides stated above, the quantities shown in the following table are needed by unit headquarters.

Headquarters Allowances

	1	2	3	4	5	6
		Small-scale maps	Medium-scale maps	Large-scale maps	Road maps	Air charts
1	Unit	(1 : 1,000,000) to (1 : 5,000,000)	(1 : 100,000) to (1 : 500,000)	(1 : 25,000) to (1 : 50,000)	(Various scales)	(Various scales)
2	Army HQ.....	25	75	50	75	50
3	Corps HQ.....	15	40	75	50	25
4	Div HQ.....	5	25	55	50	10
5	BG.....	1	7	¹ 14	15	3
6	Bn HQ.....	0	3	¹ 12	5	0
7	Co HQ.....	0	1	(²)	1	0

¹ Group and battalion needs for service units are 50 percent of those for combat units.

² Fifty percent of the needs for combat companies in (b) above, or one copy per company, whose needs are based on officer strength.

(2) *Tables of initial allowances.* Tables of initial allowances of the several classifications of maps for infantry, armored, and airborne divisions are furnished below. These figures are computed according to the basis outlined above and constitute quantities

for initial issue. They are to be considered as a guide only. Allowance for other units can be computed in accordance with the rules in (1) above.

(a) *Airborne division, TOE 57T ROTAD.*

	1	2	3	4	5	6	7
	Unit	No.	Small scale	Medium scale	Large scale*	Road	Aerochart
2	Bn, comd and con.....	1	5	29	199	231	116
3	HQ & HQ oc.....	1	-----	(1)	(73)	(150)	(10)
4	Co, admin.....	1	-----	(1)	(26)	(18)	-----
5	Co, avn.....	1	-----	(1)	(74)	(28)	(70)
6	Trp, cav.....	1	-----	(1)	(26)	(35)	(36)
7	BG, abn.....	5	1	70	470	1,160	15
8	HQ & HQ co.....	1	(1)	(1)	(24)	(79)	(3)
9	Btry, mort, 105-mm.....	1	-----	(1)	(20)	(43)	-----
10	Co, rifle.....	5	-----	(1)	(10)	(19)	-----
11	Div arty.....	1	1	14	35	203	3
12	HQ & HQ btry.....	1	(1)	(1)	(22)	(44)	(3)
13	Btry, FA how, 105-mm.....	5	-----	(1)	(9)	(19)	-----
14	Btry, FA msl, 762-mm rkt.....	1	-----	(1)	(4)	(49)	-----
15	Bn, engr.....	1	-----	6	34	120	-----
16	HQ & HQ co.....	1	-----	(1)	(6)	(45)	-----
17	Co, engr.....	2	-----	(1)	(8)	(35)	-----
18	Gp, spt.....	1	1	16	83	269	3
19	HQ & HQ co.....	1	(1)	(1)	(13)	(26)	(3)
20	Co, QM precht sup.....	1	-----	(1)	(4)	(19)	-----
21	Co, sup & trans.....	1	-----	(1)	(10)	(58)	-----
22	Co, med.....	1	-----	(1)	(21)	(60)	-----
23	Bn, maint.....	1	-----	(5)	(35)	(106)	-----
24	Bn, sig.....	1	-----	6	30	89	-----
25	HQ & HQ det.....	1	-----	(1)	(6)	(19)	-----
26	Co, comd op.....	1	-----	(1)	(6)	(43)	-----
27	Co, fwd comm.....	1	-----	(1)	(6)	(27)	-----
28	Total.....		8	141	851	2,072	137

* When participating in airborne operations, initial issue of large-scale maps will be twice the number shown in this table.

(b) Armored division, TOE 17T ROCAD

	1	2	3	4	5	6	7
1	Unit	No.	Small scale	Medium scale	Large scale	Road	Aerochart
2	HQ & HQ co, armd div	1	5	26	60	100	10
3	HQ & HQ co, CC	3	1	24	60	156	9
4	Bn, armd inf	4		32	400	760	
5	HQ & HQ co	1		(4)	(32)	(90)	
6	Co, rifle	4		(1)	(17)	(25)	
7	Bn, armor, 90-mm	4		8	360	852	
8	HQ & HQ co	1		(4)	(26)	(109)	
9	Co, med tank, 90-mm	4		(1)	(16)	(26)	
10	Div arty	1	1	41	309	638	3
11	HQ & HQ btry	1	(1)	(8)	(22)	(55)	(3)
12	Bn, FA how, 105-mm, SP	3		(24)	(228)	(426)	
13	HQ & HQ btry	1		(4)	(20)	(49)	
14	Svc btry	1		(1)	(2)	(24)	
15	Btry, FA how, 105-mm, SP	3		(1)	(18)	(23)	
16	Bn, FA comp	1		(9)	(59)	(157)	
17	HQ & HQ btry	1		(4)	(18)	(37)	
18	Svc btry	1		(1)	(2)	(22)	
19	Btry, FA how, 155-mm, SP	2		(1)	(12)	(24)	
20	Btry, FA how, 8-in, SP	1		(1)	(11)	(23)	
21	Btry, FA msl, 762-mm rkt, SP	1		(1)	(4)	(27)	
22	Sq, cav	1		8	82	269	
23	HQ & HQ trp	1		(4)	(22)	(85)	
24	Trp, recon	4		(1)	(15)	(46)	
25	Bn, engr	1		9	62	153	
26	HQ & HQ co	1		(4)	(32)	(70)	
27	Co, brg	1		(1)	(6)	(54)	
28	Co, engr	4		(1)	(6)	(29)	
29	Bn, sig	1		6	34	150	
30	HQ & HQ co	1		(4)	(25)	(55)	
31	Co, comd op	1		(1)	(5)	(53)	
32	Co, fwd comm	1		(1)	(4)	(42)	
33	Co, avn	1		1	125	42	100
34	Co, MP	1		1		53	
35	Div tn	1	1	26	129	420	3
36	HQ & HQ det and band	1	(1)	(8)	(15)	(25)	(3)
37	Bn, QM	1		(6)	(21)	(172)	
38	Bn, ord	1		(5)	(46)	(103)	
39	Bn, med	1		(6)	(39)	(105)	
40	Co, admin	1		(1)	(8)	(15)	
41	Total		8	182	1,546	3,593	125

(c) Infantry division, TOE 7T ROCID

	1	2	3	4	5	6	7
1	Unit	No.	Small scale	Medium scale	Large scale	Road	Aerochart
2	HQ & HQ co, inf div	1	5	26	60	153	10
3	BG, inf	5	5	65	385	755	15
4	HQ & HQ co	1	(1)	(8)	(19)	(87)	(3)
5	Co, rifle	4		(1)	(10)	(9)	
6	Btry, mort, 105-mm	1		(1)	(18)	(28)	
7	Div arty	1	5	27	152	404	3
8	HQ & HQ btry	1	(1)	(8)	(16)	(65)	(3)
9	Bn, FA, how, 105-mm, towed	1	(1)	(10)	(88)	(193)	
10	HQ & HQ btry	1	(1)	(4)	(16)	(33)	
11	Svc btry	1		(1)	(2)	(20)	

	1	2	3	4	5	6	7
	Unit	No.	Small scale	Medium scale	Large scale	Road	Aerochart
12	Btry, FA how, 105-mm, towed-----	5		(1)	(14)	(28)	
13	Bn, FA comp-----	1	(1)	(9)	(48)	(146)	
14	HQ & HQ btry-----	1	(1)	(4)	(16)	(33)	
15	Svc btry-----	1		(1)	(2)	(24)	
16	Btry, FA how, 8-in, towed-----	1		(1)	(8)	(21)	
17	Btry, FA msl, 762-mm rkt, SP-----	1		(1)	(2)	(28)	
18	Btry, FA how, 155-mm, towed-----	2		(1)	(10)	(20)	
19	Bn, armor, 90-mm-----	1	1	9	92	209	
20	Sq, cav-----	1	1	7	44	169	
21	Bn, engr-----	1	1	9	34	177	
22	Bn, sig-----	1	1	6	38	144	
23	Div tn-----	1	3	28	287	540	103
24	HQ & HQ det & band-----	1	(1)	(8)	(22)	(26)	(3)
25	Bn, ord-----	1		(5)	(32)	(105)	
26	Bn, med-----	1	(1)	(6)	(46)	(65)	
27	Bn, trans-----	1	(1)	(6)	(35)	(233)	
28	Co, QM-----	1		(1)	(10)	(62)	
29	Co, admin-----	1		(1)	(23)	(13)	
30	Co, avn-----	1		(1)	(119)	(36)	(100)
31	Total-----		22	177	1,092	2,551	131

(3) *Summary of totals for larger units*
(Numbers given are number of copies
of each map for initial issue and in-

clude a small reserve to be held under
unit control.)

	1	2	3	4	5	6
	Unit	Small-scale maps	Medium-scale maps	Large-scale maps	Road maps	Air ¹ charts
		(1 : 1,000,000) to (1 : 5,000,000)	(1 : 100,000) to (1 : 500,000)	(1 : 25,000) to (1 : 50,000)	(Various scales)	(Various scales)
2	Army HQ and all army non- divisional troops-----	50	600	1,500	4,500	200
3	Corps HQ and all corps non- divisional troops-----	40	600	1,500	3,000	100
4	Inf div-----	16	200	1,100	2,600	140
5	Armd div-----	8	200	1,600	3,600	150
6	Abn div-----	8	150	² 1,000	2,100	140

¹ Production and distribution are Air Force responsibilities. Normally, Air Force distribution to troops is in bulk to zone of interior and communications zone map depots; and the engineer makes detailed distribution.

² Is 1,500 for airborne operations.

e. *Replenishment Requirements.* The following percentages refer to quantities an army requires under its control (in addition to the initial issue) in army map depots:

Small scale----- 100% of initial requirements.
Medium scale----- 100% of initial requirements.
Large scale----- 50% of initial requirements.

f. *Number of Colors or Press Impressions.*
Maximum -- 8.

Standard -- 5 (black, brown, blue, green, and red).

Expedient -- 1, 2, 3.

Two- and three-color maps are far superior to one color and should be adopted where time for standard color reproduction is not available.

g. *General Factors.*

Initial issue—

Army 2,700,000 sheets-- 135 tons

Corps 420,000 sheets---- 21 tons

Replenishment—

Army 180,000 sheets/day 9 tons/day

3.5. Production of Military Maps

a. Capabilities of Mapping Units.

	1	2	3	4	5	6
1	Units	Maps reproduced	Methods of reproduction	Sheet size (inches)	Remarks	Capabilities
2	Engineer base topographic battalion. One per army group of three armies, assigned to theater, located in communications zone.	Maps in large quantities. Maps of permanent utility. Special sketches and drawings. Photomaps. Production and revision of new and existing maps of all types and scales.	Lithography in one or more colors. Contact prints (limited numbers only). Duplicator (hectograph and similar means).	22½ x 29 35 x 45	Battalion is prepared to take over and operate presses of large sizes. Generally assigned long-range mapping projects.	New mapping—50 sq mi per day, beginning 21 days after receipt of aerial negatives required. Photomaps—100 sq mi per day, beginning 10 days after receipt of aerial negatives. Simultaneous with topographic mapping reduces the latter by 20 sq mi per day. Reproduction—4,000,000 impressions per month on runs of 20,000 copies. Surveying—Six field parties for triangulation, traverse, or level line instrumental survey. Five sq mi per day of plane table survey at a scale of 1:10,000 or smaller.
3	Engineer topographic battalion, army. One per army.	Revision and reproduction of existing maps. Provisional maps and photomaps of unmaped areas for tactical and fire-control use. Sketches and drawing.	Lithography in one or more colors. Contact prints (limited numbers). Duplicator (hectograph and similar means).	22½ x 29	Battalion organized for quantity reproduction to meet the more local reproduction needs of the Army.	Map revision—10 sq mi per day, beginning 15 days after receipt of photographs. Photomaps—40 sq mi per day, beginning 15 days after receipt of photographs. Reproduction—1,200,000 impressions per month on topographic maps in colors. Surveying—One field survey platoon with four field survey parties capable of triangulation, traverse, level line, and plane table survey.
4	Engineer topographic company, corps. One per corps.	Revision and reproduction of existing maps. Provisional and photomaps. Mosaics. Maps of limited areas. Overlays and sketches.	Lithography in one or more colors. Contact prints (very limited numbers only). Duplicator (hectograph and similar means).	22½ x 29	Multicolor reproduction possible in cases where exactness in matching color plates is not essential and time is available.	Map revision—5 sq mi per day, beginning 10 days after receipt of photographs. Photomaps—30 sq mi per day, beginning 3 days after receipt of photographs. Reproduction—600,000 impressions per month on topographic maps in colors. Surveying—Two field survey parties capable of instrumental surveys.
5	Division engineers-----	Simple sketches, overprints, and overlays.	Spirit duplicator. Duplicator (hectograph and similar means).	22½ x 29 22½ x 33	Lithographic reproduction not possible.	

b. Production Data by Map Type^{1 2 3}

	1	2	3	4	5	6	7	8	9	10
1	Kind of map	Scale	Contour interval (ft)	Sheet size (in.)	Size of area	Purpose	Natural features and works of man shown	Originals and limited number of copies prepared by—	Reproduced in quantity by—	Probable time or conditions when available ⁴
2	Vertical aerial photograph.	1:5,000 to 1:60,000 (12 inches = 1 mile to 1 inch = 1 mile).	-----	Varies-----	Varies depending on scale.	Intelligence. Map supplement for study of terrain and other detail. Mosaic, preparation of stereopairs and triplets.	Varies-----	Air Force, Navy, and civilian agencies.	Lithographic copies by base and army topographic battalions, and corps topographic companies. Contact prints by Signal airphoto reproduction and delivery companies.	Limited numbers: 3 to 5 hours after photography. Quantities: 48 hours after photography. ⁵
3	Oblique aerial photograph.	Varies-----	-----	Varies-----	Varies depending on scale.	Intelligence. Map supplement for study of terrain and other detail.	Varies-----	(As above)-----	(As above)-----	(As above).
4	Tri-metrigon photograph.	Vertical: As taken. Oblique: Varies.	-----	Max of 22½ by 29.	Varies depending on scale.	Map supplement, aeronautical chart production.	Varies-----	(As above)-----	(As above)-----	(As above).
5	Photomap-----	Approximately 1: 5,000, 1:10,000, 1:25,000, 1:50,000.	-----	Max of 22½ by 29.	Varies depending on scale.	General field uses as map supplement. Limited horizontal control for unobserved artillery fire.	Varies-----	Base and army topographic battalions. Corps topographic companies. Civilian agencies.	Base and army topographic battalions. Corps topographic companies (lithographic copies)	75 to 185 man-hours. 24 to 72 hours after photography, depending on amount of control used. Time includes mosaic and reproduction.
6	Mosaic-----	As taken, enlarged, or reduced.	-----	Maximum of 22½ by 29 depending on organization printing.	Varies depending on scale.	General field uses as map supplement. Approximate horizontal control or	Varies-----	Army topographic battalions. Corps topographic companies. Civilian	Army topographic battalions. Corps topographic companies (lithographic	75 to 100 man-hours. 24 to 48 hours after photography. Time includes

						limited unobserved artillery fire.		agencies. Air Force units up to ten prints, when directed by proper authority.	copies).	mosaics and reproduction.
7	Strip mosaic	As taken, enlarged, or reduced.		Depends on number of photographs.	Varies depending on scale.	General field uses as map supplement. Approximate horizontal control for limited unobserved artillery fire.	Varies	Air Force. Corps topographic companies. Civilian agencies.	Corps topographic companies (lithographic copies).	50 to 75 man-hours or 24 hours after photography. Time includes mosaics and reproduction.
8	Small-scale map.	1:1,000,000	Metric contours at 100, 200, 500, 1,000, 1,500, 2,500, 3,000, 35,00, 4,000, and even thousands thereafter.	26 x 32	Standard 4° NS by 6° EW.	Strategy and logistics.	Drainage, relief with gradient tints, populated places, communications.	Army Map Service.	Army Map Service and base reproduction plants	700 to 2,000 man-hours. Time includes compilation, drafting, reproduction. Reproductions: 24 hours.
9	Topographic map, contoured, medium scales. ⁶	1:250,000	Foreign: 20 or 100 meters. US: 100 or 500 ft, augmented with hill shading.	Max 24 x 28	Standard 1° NS by 2° EW.	Strategy and logistics. Mechanized and motorized units.	Stream lines, vegetation, and ground forms. Railroads, roads, towns, airfields, etc.	Army Map Service.	Army Map Service and base reproduction plants.	700 to 4,000 man-hours. Time includes compilation, drafting, reproduction. Reproductions: 24 hours.
10	Topographic map, contoured. ⁶	1:100,000	US: 20 or 100 ft. Foreign: 10, 20, or 40 meters.	Max 22½ x 29	US: 30' x 30'. Foreign: 20' NS x 30', 40', or 60' EW depending upon latitude.	Substitute for 1:50,000 topographic map.	Stream lines, vegetation, and ground forms. Railroads, roads, towns, airfields, etc.	Army Map Service. All military cartographic units.	All military reproduction units.	450 to 5,000 man-hours depending on compilation method. Time includes compilation, drafting, and reproduction. Reproductions: 24 to 48 hours.

See footnote at end of table.

	1	2	3	4	5	6	7	8	9	10
1	Kind of map	Scale	Contour interval (ft)	Sheet size (in.)	Size of area	Purpose	Natural features and works of man shown	Originals and limited number of copies prepared by—	Reproduced in quantity by—	Probable time or conditions when available ⁴
11	Topographic map, contoured. ⁷	1:50,000 ----	US: 5 to 50 ft. Foreign: 10 or 20 meters.	Max 22½ x 29	US: 15' x 15'. Foreign: 10' NS x 15', 20', or 30' EW depending upon latitude. (Certain exceptions.)	General field uses. Tactical and logistical studies by units from corps to regiment.	Drainage systems, water, relief, and forested areas. Railroads, roads, bridges, dams, towns, buildings, etc.	All military cartographic units.	All military reproduction units.	500 to 9,000 man-hours depending upon compilation method. Time includes compilation, drafting, and reproduction. Reproductions: 24 to 48 hours.
12	Topographic map, contoured. ⁷	1:25,000 -----	US: 5 to 50 ft. Foreign: 10 or 20 meters.	Max 22½ x 29	US and Canada: 7½ ¹ x 7½'. Foreign: 5' NS x 7½ ¹ , 10', or 15' EW depending upon latitude. (Certain exceptions.)	General field use. Tactical and logistical studies by units from corps to regiment.	Drainage systems, water, relief, forested areas. Railroads, roads, bridges, dams, populated places, buildings, coastal hydrography, etc.	All military cartographic units.	All military reproduction units.	600 to 4,500 man-hours depending upon compilation method. Time includes compilation, drafting, and reproduction. Reproductions: 24 to 48 hours.
13	Coast charts and harbor charts.	Miscellaneous-----		Varies-----	Varies, depending on scale.	Coast artillery in harbor defense. All arms in coastal frontier defense. Transportation boat and harbor craft units. Required for piloting and navigation.	Hydrography, stream lines, coast line. Harbor, docks, aids to navigation, railroads, roads, towns, airfields, etc.	Coast and Geodetic Survey, U. S. Hydrographic Office. U. S. Lake Survey Office.	Coast and Geodetic Survey. Base reproduction plants. Base and army topographic battalions.	Reproductions: 24 to 48 hours.
14	Transportation maps.	Miscellaneous, frequently 1:1,000,000.	Contours seldom shown.	Varies-----	Varies-----	Logistics, maintenance, and operation of	Roads and railroads, drainage systems,	Base plants, civilian agencies,	Civilian agencies. Base reproduc-	Reproductions: 24 hours more.

						communications.	water, etc.	Public Roads Administration.	tion plants. Base and army topographic battalions. Corps topographic companies.	
15	Road maps (civil).	Miscellaneous.	-----	Varies.	Varies.	Logistics. Concentration of mechanized units. Maintenance and operation of communications.	Drainage systems, water, etc.	Civilian agencies.	Automobile associations, oil companies, etc.	4 to 12 hours elapsed time, depending upon number of colors. Time for reproduction only.
16	Aeronautical charts pilotage.	1:1,000,000 and 1:250,000.	Elevations shown by color or gradients.	Varies.	Varies.	Aerial navigation and as small scale map substitute.	Stream lines and ground forms. Railroads, roads, towns, airfields, and aids to aerial navigation.	Coast and Geodetic Survey. U. S. Hydrographic Office. Corps of Engineers.	Coast and Geodetic Survey. U. S. Hydrographic Office. Base reproduction plants.	Reproductions: 24 to 48 hours.
17	Aeronautical charts, approach.	1:250,000 to 1:50,000 or larger.	-----	14 by 17 or larger.	Varies.	Used by air in approaching objectives.	Prominent features, roads, etc.	Air Force.	Air Force.	24 hours and up.
18	Aeronautical charts, target.	1:75,000 (varies).	-----	14 by 17 or larger.	Varies.	Contains information necessary to distinguish assigned air targets.	Prominent features, roads, etc.	Air Force.	Air Force.	24 hours and up.

¹ The information contained in this table is in accordance with present military standards. Appropriate modifications are necessary for emergency war-time reproduction of foreign maps and of US maps made by civilian agencies.

² Maps of foreign theaters available for initial operations will vary from direct one-color reproduction of foreign maps without translation of names and symbols, to multicolor maps compiled in accordance with US standards. Any of the maps listed herein may be issued in a hasty and less accurate form, in which case they are called provisional maps.

³ In the United States, topographic maps also are published by civilian agencies at a variety of scales, including 1:24,000, 1:31,680, 1:62,500, 1:63,360, and 1:125,000. Various additional scales also may be encountered in foreign maps.

⁴ Size of run and number of colors will govern reproduction time. Estimated time is given in man-hours for 1,000-sheet runs unless otherwise indicated. Generally, actual number of days for peacetime mapping can be determined by dividing man-hours by 40 (average 5 men working simultaneously on an 8-hour day); elapsed time during wartime will be reduced upon number of men working simultaneously and number of hours worked by each per day. Time estimates are predicted upon adequately organized equipped, and trained mapping (Air Force and engineer) and reproduction engineer troops. Under less favorable conditions, more delay must be expected.

⁵ Under most favorable conditions, a single wet-print can be dropped within 30 minutes after photography when the rapid type of photography is used, in which case no negative is available.

⁶ Overprinted with 10,000 meter Universal Transverse Mercator Grid.

⁷ Overprinted with 1,000 meter Universal Transverse Mercator Grid.

c. General Production Factors.

- (1) In planning an operation, map requirements are estimated well in advance of the operation and are requisitioned from the zone of interior. Theater, army, and corps produce maps to supplement planned requirements. As a general rule, supplemental maps of a scale of 1:100,000 and larger are reproduced by army and corps; maps of 1:250,000 and smaller scale, by the communications zone.
- (2) Press size—22½ x 30 inches.
- (3) Impressions per press-day—30,000 (bulk work only).
- (4) Average map paper consumption per army ----- 5,000 reams/month.
167 reams/day.
- (5) Maximum map paper consumption per army ----- 500 reams/day.
- (6) Photomap paper consumption per army ----- 1,000 reams/month.

d. Production Capacity Required.

- (1) Army—3,000,000 impressions per month.
- (2) *Communications zone.*
 - (a) Five million impressions per month for each three armies supported.
 - (b) A new mapping capacity of 100 square miles per day.

3.6. Storage of Maps

a. Weights and Cubages.

(1) Paper.

Sheet size (in.)	Line map—high wet strength ¹ (lb per 1,000 sheets)	Photomap—coated two sides (lb per 1,000 sheets)
22½ x 29-----	85.7-----	98.4
22 x 29-----	81.9-----	94.1
24 x 34-----	104.7-----	120.4
26 x 32-----	106.8-----	122.7
28 x 50-----	179.6-----	206.5
Sheet thickness-----	.0040-in-----	.0035-in.
Thickness, 1,000 sheets--	4-in-----	3.5-in.

¹For US hydrographic charts, use twice weights shown for high wet-strength paper.

(2) Crated or bundled maps.

Packaging	Weight ¹	Cubage
Bundle, 500 map sheets-----	60 lb-----	2 cu ft
Crate, 1,000 map sheets-----	150 lb-----	5 cu ft

¹ Average figure for planning purposes.

b. Floor Space.

- (1) Base map depot for each group of 3 armies—45,000 square feet, increasing at the rate of 7,500 square feet per month of operations.
- (2) Base map depot for each air force—10,000 square feet, increasing at the rate of 2,000 square feet per month of operations.
- (3) Advance map depots serving each army—10,000 square feet.

3.7. Map Distribution

a. *General.* Although maps are an item of class IV supply, there are several features which establish them as a peculiar supply item which must be handled separately through a system set up exclusively for this purpose. The special features which place map distribution in a class by itself are—

- (1) *Security.* Bulk production, movement, and issue of maps are accurate indexes of the scope of forthcoming operations.
- (2) *Transitory application.* Changes in culture as revealed by the constantly expanding sources of information may quickly render maps obsolete and may require several improved editions or issues in the course of a single operation.
- (3) *Relation to the operation.* Unlike other supply items, maps have a direct relation to the exact place in which the operation is to occur.
- (4) *Phasing of supply.* In general, bulk stocks of maps cannot be prepared, and distribution planned, far in advance. However, collection of source material for map production must be constant and worldwide. Production must be phased to insure the application of the last bit of terrain information which can be safely used. Issue can be made only after an exact assignment of missions has been made.

b. Responsibility.

- (1) Map requirements for a command are computed by the engineer under the staff supervision of the G2. Requisitions are prepared and submitted through engineer channels in sufficient

time to permit the reproduction and shipment of the maps required.

- (2) Engineers of divisions and larger units are charged with the distribution of military maps in the field, except such confidential or secret maps as may require special distribution. They obtain maps not printed by their echelons from the engineers of the next higher units.

c. Depots.

- (1) *Peacetime and zone of interior.* Distribution is made by requisitions drawn on the Army Map Service through channels as prescribed by the Chief of Engineers.

- (2) *Wartime theater of operations.*

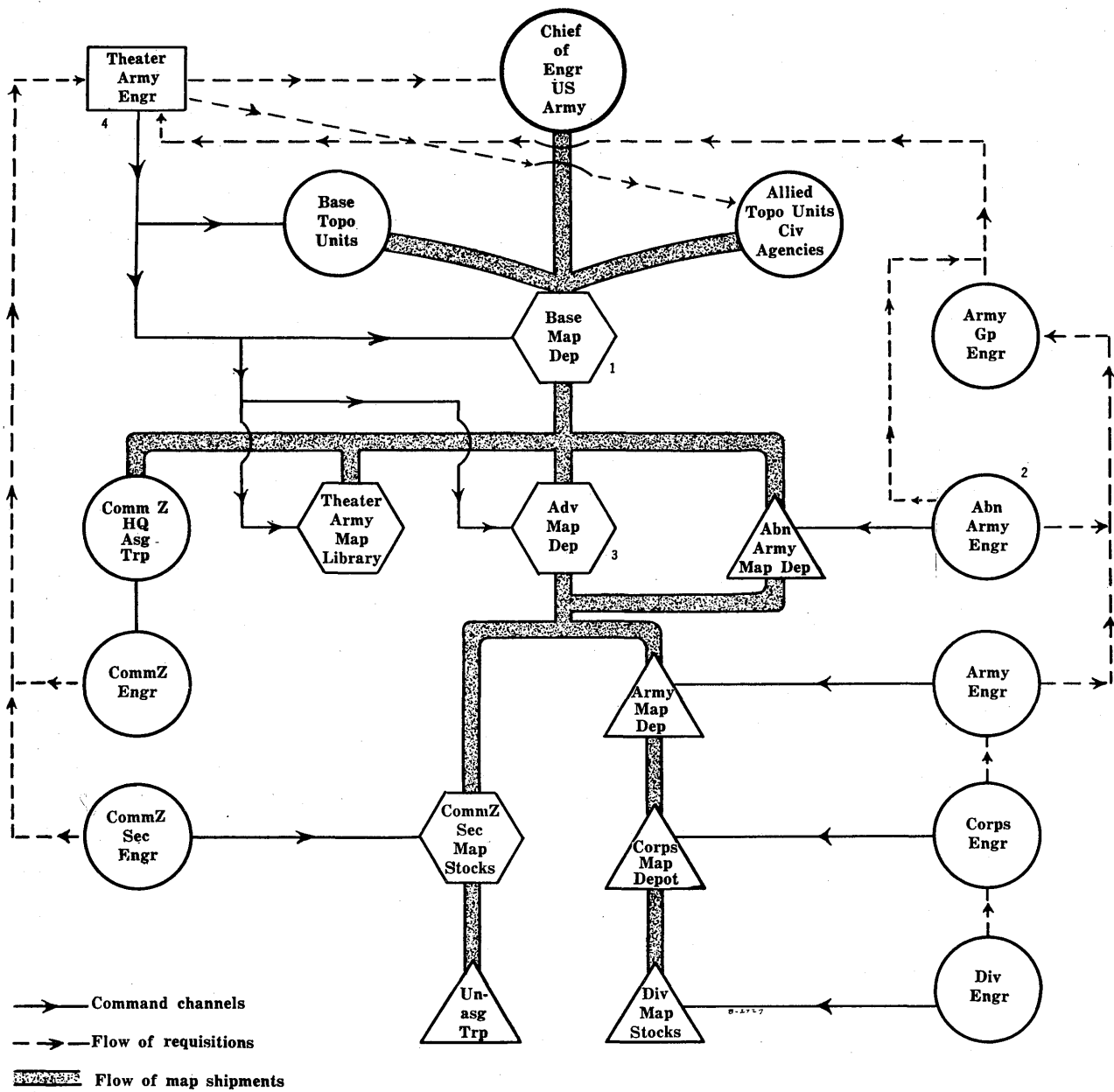
- (a) Base and advance depots are located in the communications zone, with the advance depot near the forward limit of the communications zone. Base map depots receive and store bulk stocks from the Army Map Service and base reproduction plants; break down and distribute bulk stocks to advance depots; distribute to base depot units; and operate a retail map store for base headquarters. Advance map depots receive and store bulk stocks from base map depots; break down and distribute bulk stocks to army map depots; and operate a retail map

store for the headquarters of units located in the area.

- (b) The army map depot is located in the army service area, usually near army rear headquarters. In a fast-moving operation it may be necessary to operate two map depots which leapfrog over each other as the army headquarters moves forward. The army map depot has functions parallel to those of the base map depot. The depot is operated by the map storage and distribution section of the army topographic battalion.
- (c) The corps map depot is located in the corps rear area and has the same functions as the base map depot, but on a smaller scale. It is operated by a section of the corps topographic company.
- (d) Operation of the division map stores is the responsibility of the division engineer. The only functions performed are to receive bulk stocks, distribute maps to divisional and attached units, and store the division reserve map stocks.

d. Labor Estimates. Map depot labor may be estimated at 20 man-hours per 10,000 maps issued, including rolling, coding, packing, and collating unit packages.

e. Flow Chart.



Notes

- * 45-day reserve supply.
- * Channels of requisitions and map shipments for airborne units depend upon location and assignment of these units in the theater of operations.
- * 10-day supply.
- * Air Force map depots are supplied with maps, other than aeronautical charts, in the same manner as Army depots. Air Force engineers submit requisitions to theater army engineer.

3.8. Determining Map Requirements

a. *Preliminary Planning.* Army G2 confers with G3 to determine the types and scales of maps to be used by subordinate units and army headquarters. An operational map is selected for use by army and corps headquarters so that all orders, overlays, and references will be based on the same map. The army engineer attends these staff conferences to advise on the availability of maps in army and base map depots, capacity of reproduction facilities, and types and scales which can be most readily reproduced. G3 outlines the area for which map coverage is desired. This area will be well in advance of the present frontlines of the army because of the time required for procurement, production, reproduction, and distribution of maps. In addition, maps of the future area of operations are required early for planning purposes. G3 also outlines tentative future dispositions, direction of attack, and boundaries of army and subordinate units. This tentative information will be used by the engineer in determining map requirements for the army.

b. *Method.* With the information furnished by G2, G3, and the data in paragraphs 3.1-3.6, or similar data developed through experience, the army engineer calculates map requirements for all units of the army and army headquarters. The procedure is as follows:

- (1) Lay out the projected army area for which coverage is desired on the pertinent index map.
- (2) In the army area outlined on the index map, lay out the tentative corps and division boundaries. Project these boundaries to cover the entire area for which map coverage is desired. While these projected boundaries will change during the campaign, divisions and corps of the army will operate in the area. Therefore, calculations based on one pattern of operations are valid for map procurement purposes.
- (3) List the units requiring each map sheet. Note that divisions in reserve will require map sheets of the entire front in which they may be employed.
- (4) List the identifying numbers of the map sheets required to cover the area included within the army boundaries,

including sheets bordering closely on the boundaries.

- (5) Determine the number of copies of each sheet required at each echelon, using factors in paragraph 3.4d(3), or developed experience factors.
- (6) List the total number of copies of each map sheet required. These are planning figures for *initial issue*. *Replenishment requirements* are determined by multiplying the numbers of each sheet required for initial issue by the proper percentage factor in paragraph 3.4e. The sum of the initial requirement plus the replenishment requirement for each sheet represents the total number of copies of each sheet that must be procured. These are procured from higher echelon or produced by topographic units within the army.

3.9. Terrain Models

a. Classification.

Type of model	Horizontal scale	Vertical exaggeration
Strategic planning--	1:250,000 and smaller--	4:1 up to 10:1
Tactical planning--	1:100,000 to 1:25,000--	2:1 up to 4:1
Assault landing----	1:25,000 to 1:5,000-----	1:1 up to 2:1
Airborne landing----	1:5,000 to 1:500-----	1:1 up to 2:1
Assault-----	1:10,000 and larger-----	1:1 up to 2:1
Aerial target-----	1:5,000 to 1:2,500-----	1:1 up to 2:1

b. *Quantity Requirements.* The determination of quantity requirements and the issuance of terrain models are matters for staff control. Terrain models and plastic relief maps are seldom stocked outside base plants. The Army Map Service is currently the only base plant for terrain models and does stock plastic relief maps at scales of 1:250,000, 1:1,000,000, and certain other miscellaneous scales. These maps can be requisitioned through proper engineer channels. Quantity requirements depend solely upon the estimate of the military situation. The necessary provisions to meet those requirements are determined by staff studies of combat needs; the resultant production and supply of models are determined by command decision. The commander, having model making units under his control, directs that a G2 intelligence study and

an engineer technical appraisal be performed to determine what models are to be constructed. When assigned model making capacities are inadequate, the commander submits appropriate

requests to higher headquarters. Upon completion of construction, the model is issued immediately and directly to the headquarters or command for which it was produced.

c. Production Rates.

1	2	3	4		5	6	7	8
Unit	Type of model	Per-centage of pro-duction capac-ity	Man-hours		Num-ber of quads per month	Output of original in sq ft per 8-hr day	Output of copies in sq ft per 8-hr day	Man-hours per square foot of origi-nal
			Class	Per day				
Theater HQ, 3 platoons, 6 officers, 120 enlisted men.	RUBBER CASTINGS							
	Assault (hand painting required).	100	Con----- Control-- Repro-- Finish--	472 104 40 288	19	5.2	57.5	165
	Total..	100	-----	904	9	5.2	57.5	165
CONUS HQ, 12 officers, 238 enlisted men----	VINYL-PLASTIC EMBOSSED MODELS							
	Assault-----	25	339		24	4.2	112	80
	Tactical-----	45	610		24	4.3	112	140
	Strategic-----	30	408		17	2.9	74	140
	Total..	100	1,357		65	11.4	298	360
Theater HQ, 6 officers, 120 enlisted men----	Assault-----	50	260		18	3.3	112	80
	Tactical-----	40	208		8	1.5	74	140
	Strategic-----	10	52		2	.4	37	140
	Total..	100	520		28	5.2	223	360
TOE 5-500, relief mapmaking team, 1 officer, 18 enlisted men.	Assault-----	50	52		3	0.65	37	80
	Strategic-----	50	52		2	.37	37	140
	Total..	100	104		5	1.02	74	220

¹³ x 5 ft.

²² x 29 in.

Section III. AERIAL PHOTOGRAPHY

3.10. Aerial Photography

a. *Types of Aerial Photos.* An aerial photo is any photograph taken from the air. Aerial photos may be taken with black-and-white, color, or infrared film. The following are types of aerial photos:

- (1) *Vertical photo.* An aerial photo taken with the optical axis of the camera approximately vertical to the earth's surface. The scale of vertical photography is approximately uniform throughout the image.
- (2) *Oblique photo.* An aerial photo taken with the camera axis intentionally directed between the horizontal and vertical. The scale of an oblique photo decreases progressively from foreground to background.
- (3) *Composite.* An aerial photo made by assembling the separate photographs taken by each lens of a multiple lens camera in a simultaneous exposure.
- (4) *Stereopair.* Two aerial photos with sufficient overlap and consequent duplication of detail to make possible stereoscopic examination of an object or area common to both.
- (5) *Mosaic.* An assemblage of overlapping aerial photographs whose edges have been matched to form a continuous photographic representation of a portion of the earth's surface.
- (6) *Continuous strip photo.* An aerial photo of a strip of terrain in which the image remains unbroken throughout the entire length of the film. The film is synchronized with the speed of the aircraft.

b. *Types of Aerial Photo Coverage.* The term *aerial photo coverage* denotes the ground area represented on aerial photos, photomaps, and mosaics. Aerial photo coverage falls into two general classes: intelligence cover and mapping cover. (For information on mapping cover, see paragraphs 3.2 through 3.9.) The following are types of intelligence cover:

(1) *Basic cover.* Basic cover is complete photo coverage of a projected area of operations flown periodically or seasonally to fulfill general operational and intelligence requirements and to provide, with subsequent photography, a basis for comparative photo studies. Basic cover usually extends from the line of contact with enemy ground forces to a depth of 100 miles or more, as required, into enemy-held territory. For greatest effectiveness, basic cover should be at a scale of 1:12,500 or larger.

(2) *Frontline cover.* Frontline cover is current vertical stereoscopic photography across the field army front, extending from the line of contact with enemy ground forces to a depth determined by operational and intelligence requirements. The depth to which it is flown is usually determined by the maximum range of friendly artillery or by the location of selected objectives during an offensive operation. For maximum effectiveness, it should be at a scale of 1:10,000 or larger. Frontline cover is flown as requested by army.

(3) *Special cover.* Special cover is photography specifically requested for special study of selected targets or critical areas to meet immediate information requirements of combat units. The scale and type of photography will vary, depending upon the type of target and the information required.

c. *Aerial Photo Requirements.*

(1) An initial issue of basic cover is made to army units according to their requirements. Supplemental issues are made as required during the progress of the campaign. Typical initial issue of basic cover is shown in the following chart:

	1	2	3	4	5	6	7
1	Unit or agency	No. of sets	Depth into enemy territory (mi)	No. 9 x 9 photos.		Total (aprx 1b)	
				1:25,000	1:10,000	1:25,000	1:10,000
2	Army G2 (ARSB)-----	(Based on 100-mi width) 2 sets army zone sector.	300	20,000	124,000	666	4,133
3	Army G2 (PI section)-----	(Based on 100-mi width) 1 set army zone sector.	300	10,000	62,000	333	2,066
4	Corps G2 (PI section)-----	(Based on 35-mi width) 1 set corps zone sector.	100	1,200	7,175	40	240
5	Corps arty (PI section)-----	(Based on 35-mi width) 1 set corps zone sector.	100	1,200	7,175	40	240
				ea corps	ea corps	ea corps	ea corps
				ea corps	ea corps	ea corps	ea corps
				arty	arty	arty	arty
6	Div G2 (PI section) ¹ -----	(Based on 10-mi width) 2 sets division zone sector.	50	400	2,110	17	140
				ea div	ea div	ea div	ea div
7	Div arty (PI section) ¹ -----	(Based on 10-mi width) 1 set division zone sector.	50	200	1,055	7	70
				ea div	ea div	ea div	ea div
				arty	arty	arty	arty

¹Attached to division from military intelligence battalion, army.

(2) Frontline and special cover are provided as requested by army. Maximum coordination and control must be exercised to insure that requests for frontline and special cover are not beyond the capabilities of flying organizations whether they be army organic flying organizations or organizations nonorganic to the army. The average number of photographs, size 9 x 18 inches, required to provide complete coverage, capable of being viewed stereoscopically, of various sized areas for different types of cover may be determined from a photo coverage chart. To use the photo coverage chart below, three elements of data must be known.

- The scale at which photography is desired.
- The width in meters of the area to be photographed.
- The length in meters of the area to be photographed.

Example:

Given: An area 8,000 meters wide by

12,000 meters long to be photographed at a scale of 1:5,000.

Find: The number of 9 x 18 photos required.

Solution:

- Enter the top portion of the chart labeled "Flight Lines" on the scale line 1:5. Proceed to the right until the width of 8,000 is exceeded (i.e., 8,226) and note this column.
- Enter the left hand portion of the chart labeled "Forward Coverage (Length)" in the column heading scale 1:5. Proceed down the column until 12,000 is exceeded (i.e., 12,339) and note this line.
- Proceed to the right on the line containing 12,339 to the vertical column containing 8,226 and read 162, which is the number of photos required to cover the area. By referring to the top line of the photo coverage chart, it may be determined that six flight lines are required to accomplish this photo coverage.

- (3) The following table may be used for initial rough estimates of aerial photo requirements:

Total Photo Requirements for a Field Army

Area	Cover (scale 1:10,000)			
	Basic ¹		Frontline ² (depth 15 mi)	
	Photos	wt/lb	Photos	wt/lb
Army zone/sector (based on 100-mi width).....	Depth 100 mi 10,400	728	1,600	96
Corps zone/sector (based on 35-mi width).....	Depth 50 mi 3,640	255	480	34
Division zone/sector (based on 10-mi width).....	Depth 25 mi 1,560	108	160	11

¹Based on issue table, para graphic (1)

²Per set of photos

d. Capabilities of Air Photo Reproduction and Interpretation Units.

- (1) *Signal air photo reproduction and delivery company (TOE 11-54C). See FM 11-51.*

1	2	3	4
Methods of reproduction	Sheet size (inches)	Remarks	Capabilities
Contact printing aerial photos from negatives.	Varies....	Company reproduces, identifies, and distributes prints of Air Force aerial reconnaissance photos.	Reproduction, identification, packaging, and delivery of 25,000 prints of aerial photos per operational period of 8 hours.

- (2) *Photo interpretation company.*

- (3) *Air Force photographic units.*

1	2	3
Unit	Photographs furnished	Remarks
Reconnaissance wing (theater of operations).	Specialized photography needed by topographic units for photogrammetry and photography for strategic purposes beyond the scope of reconnaissance wings of tactical air commands and tactical air forces.	Wing may include mapping and charting squadrons. Mapping photography ordinarily not suitable for intelligence purposes because of small scale and lack of detail. May contain important information, however, and prints should be made available to military intelligence officers for study.
Reconnaissance wings of tactical air commands and tactical air forces.	Photographs needed for intelligence or combat purposes (single photographs, vertical and oblique, stereopairs, or night photographs).	Also visual reconnaissance missions are capable of providing limited vertical and oblique photographs. Photographic missions capable of large quantities of high-altitude, vertical, and oblique photographs and, under extremely urgent circumstances, limited and low-altitude vertical oblique photographs.

Photo Coverage Chart

9" x 18" Film	FLIGHT LINES PERCENTAGE SIDE LAP		ONE	TWO W/40%	THREE W/40%	FOUR W/40%	FIVE W/40%	SIX W/40%	SEVEN W/40%	EIGHT W/40%	NINE W/40%	TEN W/40%
	Side coverage (width) in meters (Scale in thousands)	1:10	4,572	5,486	8,229	10,972	13,716	16,459	19,202	21,945	24,688	27,432
		1:7	3,200	3,840	5,760	7,680	9,600	11,520	13,440	15,360	17,280	19,200
		1:6	2,743	3,292	4,938	6,584	8,230	9,876	11,522	13,168	14,814	16,460
		1:5	2,285	2,742	4,113	5,484	7,855	8,226	9,597	10,968	12,339	13,710
		1:4	1,828	2,194	3,291	4,388	5,485	6,582	7,679	8,776	9,873	10,970
		1:3	1,372	1,646	2,469	3,292	4,115	4,938	5,761	6,584	7,407	8,230

FORWARD COVERAGE (LENGTH) IN METERS W/60%
OVERLAP AT SCALE IN THOUSANDS

1:10	1:7	1:6	1:5	1:4	1:3	NEGATIVES									
2,285	1,600	1,368	1,143	913	685	1	2	3	4	5	6	7	8	9	10
1,828	1,280	1,094	914	730	548	2	4	6	8	10	12	14	16	18	20
2,742	1,920	1,641	1,371	1,095	822	3	6	9	12	15	18	21	24	27	30
3,656	2,560	2,188	1,828	1,460	1,096	4	8	12	16	20	24	28	32	36	40
4,570	3,200	2,735	2,285	1,825	1,370	5	10	15	20	25	30	35	40	45	50
5,484	3,840	3,282	2,742	2,190	1,644	6	12	18	24	30	36	42	48	54	60
6,396	4,480	3,829	3,199	2,555	1,918	7	14	21	28	35	42	49	56	63	70
7,312	5,120	4,376	3,656	2,920	2,192	8	16	24	32	40	48	56	64	72	80
8,226	5,760	4,923	4,113	3,285	2,466	9	18	27	36	45	54	63	72	81	90
9,140	6,400	5,470	4,570	3,650	2,740	10	20	30	40	50	60	70	80	90	100
10,054	7,040	6,017	5,027	4,015	3,014	11	22	33	44	55	66	77	88	99	110
10,968	7,680	6,564	5,484	4,380	3,288	12	24	36	48	60	72	84	96	108	120
11,882	8,320	7,111	5,941	4,745	3,562	13	26	39	52	65	78	91	104	117	130
12,796	8,960	7,658	6,398	5,110	3,836	14	28	42	56	70	84	98	112	126	140
13,710	9,600	8,205	6,855	5,475	4,110	15	30	45	60	75	90	105	120	135	150
14,624	10,240	8,752	7,312	5,840	4,384	16	32	48	64	80	96	112	128	144	160
15,538	10,880	9,299	7,769	6,205	4,658	17	34	51	68	85	102	119	136	153	170
16,452	11,520	9,846	8,226	6,570	4,932	18	36	54	72	90	108	126	144	162	180

17,366	12,160	10,393	8,683	6,936	6,206	19	38	57	76	95	114	133	152	171	190
18,280	12,800	10,940	9,140	7,300	5,480	20	40	60	80	100	120	140	160	180	200
19,194	13,440	11,487	9,597	7,665	5,754	21	42	63	84	105	126	147	168	189	210
20,108	14,080	12,034	10,054	8,030	6,028	22	44	66	88	110	132	154	176	198	220
21,022	14,720	12,581	10,511	8,395	6,302	23	46	69	92	115	138	161	184	207	230
21,936	15,360	13,128	10,968	8,760	6,576	24	48	72	96	120	144	168	192	216	240
22,850	16,000	13,675	11,425	9,125	6,850	25	50	75	100	125	150	175	200	225	250
23,764	16,640	14,222	11,882	9,490	7,124	26	52	78	104	130	156	182	208	234	260
24,678	17,280	14,769	12,339	9,855	7,398	27	54	81	108	135	162	189	216	243	270
25,592	17,920	15,316	12,796	10,220	7,672	28	56	84	112	140	168	196	224	252	280
26,506	18,560	15,863	13,253	10,585	7,946	29	58	87	116	145	174	203	232	261	290
27,420	19,200	16,410	13,710	10,950	8,220	30	60	90	120	150	180	210	240	270	300
28,334	19,840	16,957	14,167	11,315	8,494	31	62	93	124	155	186	217	248	279	310
29,248	20,480	17,504	14,624	11,680	8,768	32	64	96	128	160	192	224	256	288	320
30,162	21,120	18,051	15,081	12,045	9,042	33	66	99	132	165	198	231	264	297	330
31,076	21,760	18,598	15,538	12,410	9,316	34	68	102	136	170	204	238	272	306	340
31,990	22,400	19,145	15,995	12,775	9,590	35	70	105	140	175	210	245	280	315	350
32,904	23,040	19,692	16,452	13,140	9,864	36	72	108	144	180	216	252	288	324	360
33,818	23,680	20,239	16,909	13,505	10,138	37	74	111	148	185	222	259	296	333	370
34,732	24,320	20,786	17,366	13,870	10,412	38	76	114	152	190	228	266	304	342	380
35,646	24,960	21,333	17,823	14,235	10,686	39	78	117	156	195	234	273	312	351	390
36,560	25,600	21,880	18,280	14,600	10,960	40	80	120	160	200	240	280	320	360	400
37,474	26,240	22,427	18,737	14,965	11,234	41	82	123	164	205	246	287	328	369	410
38,388	26,880	22,974	19,194	15,330	11,508	42	84	126	168	210	252	294	336	378	420
39,302	27,520	23,521	19,651	15,695	11,782	43	86	129	172	215	258	301	344	387	430
40,216	28,160	24,068	20,108	16,060	12,056	44	88	132	176	220	264	308	352	396	440
41,130	28,800	24,615	20,565	16,425	12,330	45	90	135	180	225	270	315	360	405	450
42,044	30,440	25,162	21,022	16,790	12,604	46	92	138	184	230	276	322	368	414	460

Section IV. TIME, TIDE, AND LIGHT

3.11. Designating Time and Date

a. *Time.* Time is expressed in a group of 4 digits, ranging from 0000 to 2400. The first 2 digits are the hours after midnight, and the remaining 2 digits indicate the minutes past the hour. When the hour can be expressed by a single digit, it is preceded by zero (0); for example, 0625 for 6:25 a. m. Correct official time is available at the nearest communication center or signal center.

b. *Date.*

- (1) The day, month, and year are expressed in that order, except when it is necessary to specify a 6-digit time group and then the following order is used: the first 2 digits indicate the day of the month, the next 2 digits indicate the hour, and the last 2 digits indicate minutes past the hour.

Example: 070625 Dec 47 (6:25 a. m. 7 Dec 47).

The day is expressed by numerals; the month is either spelled out or abbreviated. Abbreviations, if used, consist of the first three letters of the word. The year is expressed by four digits or by the last two digits.

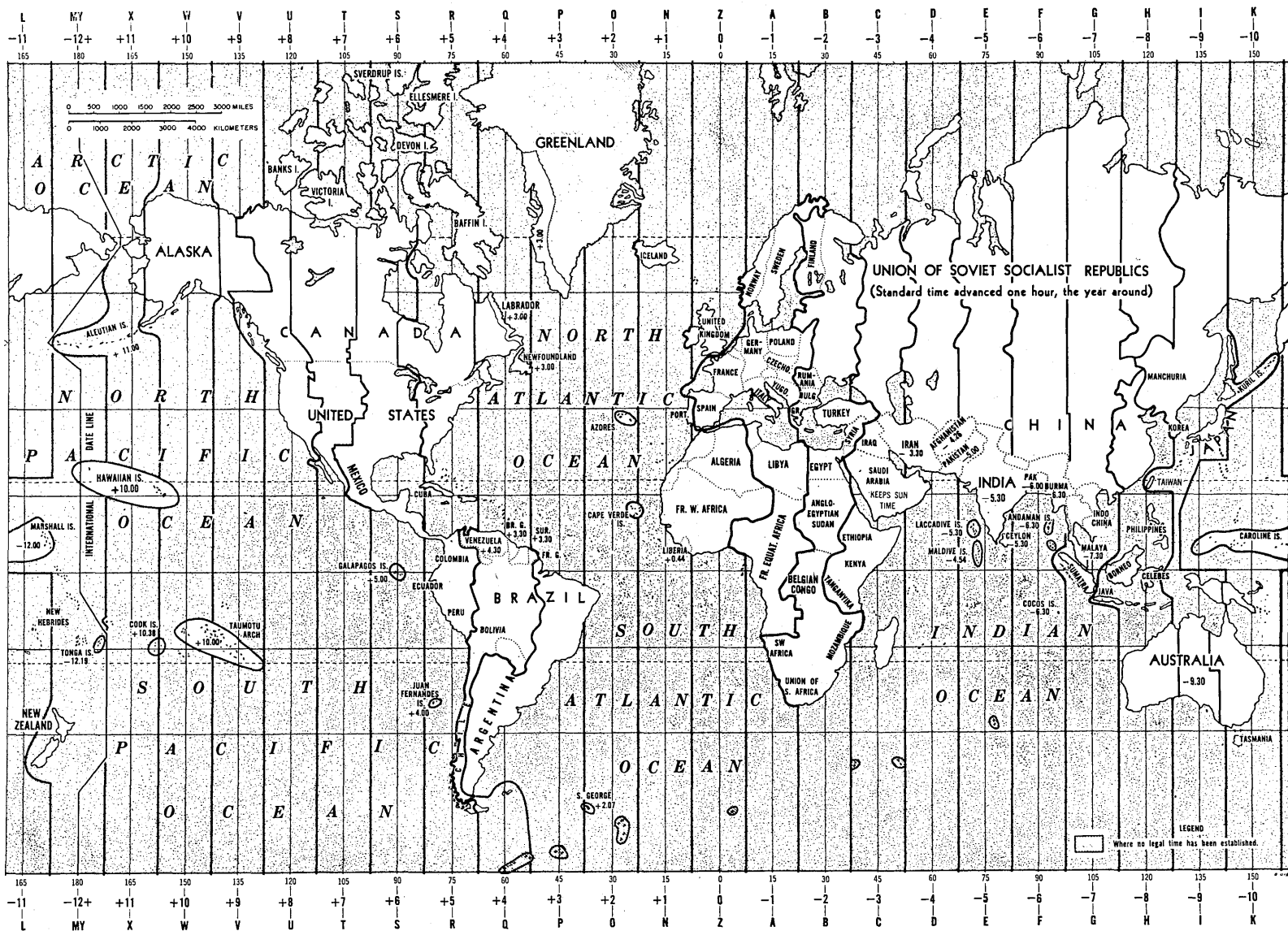
Example: 14 January 1946; 14 Jan 1946; 14 Jan 46.

- (2) When it is desired to keep the date secret, dates may be expressed by a

letter such as D plus or minus a numeral.

c. *Greenwich Civil Time.* Communications between headquarters in different time zones are usually dated, and references to dates and times are usually made in Greenwich civil time. The standard time at Greenwich, England, is accepted as the basis for measuring time throughout the world. Local civil time can be changed to Greenwich civil time by adding or subtracting the appropriate number of hours as indicated in the time zone chart, *e* below. Greenwich civil time can be changed to local civil time by reversing the signs of the time zone chart. Appropriate adjustment must be made for daylight saving time and war time.

d. *Time Suffixes.* Time groups expressing Greenwich civil time are designated by the letter suffix Z immediately following the last digit of the group. For example, 190225Z indicates 2:25 a. m. on the nineteenth of the current month, Greenwich civil time. Any other suffix used after a four-digit time group (corresponding to the Z of Greenwich civil time) indicates the zone in which the local civil time is expressed. *It does not designate location on the earth's surface.* The proper suffix can be determined from the time zone chart and the time conversion table in *e* and *f* below. For example, Kansas City is located in the sixth time zone west of Greenwich. If that city keeps local civil time, the time group suffix will be S.



TIME ZONE	HOURS OF DAY IN LOCAL TIME																																																
	PREVIOUS DAY												SAME DAY												NEXT DAY																								
0 (Z)	12	13	14	15	16	17	18	19	20	21	22	23	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	00	01	02	03	04	05	06	07	08	09	10	11	
-1 (A)	13	14	15	16	17	18	19	20	21	22	23	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	00	01	02	03	04	05	06	07	08	09	10	11	12	
-2 (B)	14	15	16	17	18	19	20	21	22	23	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	00	01	02	03	04	05	06	07	08	09	10	11	12	13	
-3 (C)	15	16	17	18	19	20	21	22	23	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	
-4 (D)	16	17	18	19	20	21	22	23	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	
-5 (E)	17	18	19	20	21	22	23	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	
-6 (F)	18	19	20	21	22	23	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	
-7 (G)	19	20	21	22	23	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	
-8 (H)	20	21	22	23	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	
-9 (I)	21	22	23	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21
-10 (K)	22	23	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22
-11 (L)	23	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	
-12 (M)	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	
+1 (N)	11	12	13	14	15	16	17	18	19	20	21	22	23	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	00	01	02	03	04	05	06	07	08	09	10	
+2 (O)	10	11	12	13	14	15	16	17	18	19	20	21	22	23	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	00	01	02	03	04	05	06	07	08	09	
+3 (P)	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	00	01	02	03	04	05	06	07	08	
+4 (Q)	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	00	01	02	03	04	05	06	07	
+5 (R)	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	00	01	02	03	04	05	06	
+6 (S)	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	00	01	02	03	04	05	
+7 (T)	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	00	01	02	03	04	
+8 (U)	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	00	01	02	03	
+9 (V)	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	00	01	02	
+10 (W)	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	00	01	
+11 (X)	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	00	
+12 (Y)	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	
	PREVIOUS DAY												SAME DAY																																				

3.12. Expression of Natural Phenomena

a. Staff officers avoid the use of such indefinite terms as *first light*, *last light*, *daybreak*, *daylight*, *darkness*, *dusk*, and *dawn*. Terms of a definite nature such as *beginning* or *ending of evening* or *morning nautical* or *civil twilights* are permissible. However, expressions of these times to lower units must be in clock time.

b. For purposes of military planning and to facilitate staff work in expressing natural phenomena in time, theater commanders prepare and publish for the theater as a whole or for major geographic portions thereof daily time, sunrise, sunset, twilight, moon, and tide tables, and specify the number of hours the local time differs from Greenwich civil time.

3.13. Tides, Sunlight, and Moonlight

a. *General.* A sample of the type of chart which should be prepared and issued for each major operation or operational area is shown in *j* below. They are available through Army channels. Data on time of sunrise, sunset, morning and evening twilight, and moon phases can also be found in TM 5-236-1.

b. *Area Covered.* The astronomical data are for sea level and will not vary more than 5 minutes for each degree of the difference in longitude from the standard meridian.

c. *Time Used.* The times on the diagram are for the time meridian indicated in the heading. When another time meridian is to be used in the field, it will be found convenient to change the figures representing hours on the left of the large diagram to conform to the new time. If the time meridian to be used is east of the one shown on the diagram, increase the figure by 1 hour for each 15°; if west, decrease the figures.

d. *Dates.* In the upper diagram, each day from midnight to midnight is represented by a space between 2 lines. In the lower diagram, the days are represented by vertical lines covering the period from noon of one day to noon of the next. The dates at the bottom of the diagram differ from those at the top because the date changes in passing through midnight.

e. *Tides.* The times of the high and low tides are shown by curves in the lower diagram. By noting the sequence of the tides during a day, the height of any particular tide can be found from the upper diagram.

f. Twilights—Morning and Evening.

(1) Twilights are the periods of solar illumination prior to sunrise and after sunset. Both morning and evening twilights are divided into three periods: astronomical, nautical, and civil. The interval of time between when the upper edge of the sun's disk appears to be exactly on the horizon and the instant the center of the sun is 6° below the horizon is civil twilight, 6°–12° nautical twilight, and 12°–18° astronomical twilight.

(a) Astronomical twilight affords such meager light, if any, that for military purposes it may be considered as a period of darkness.

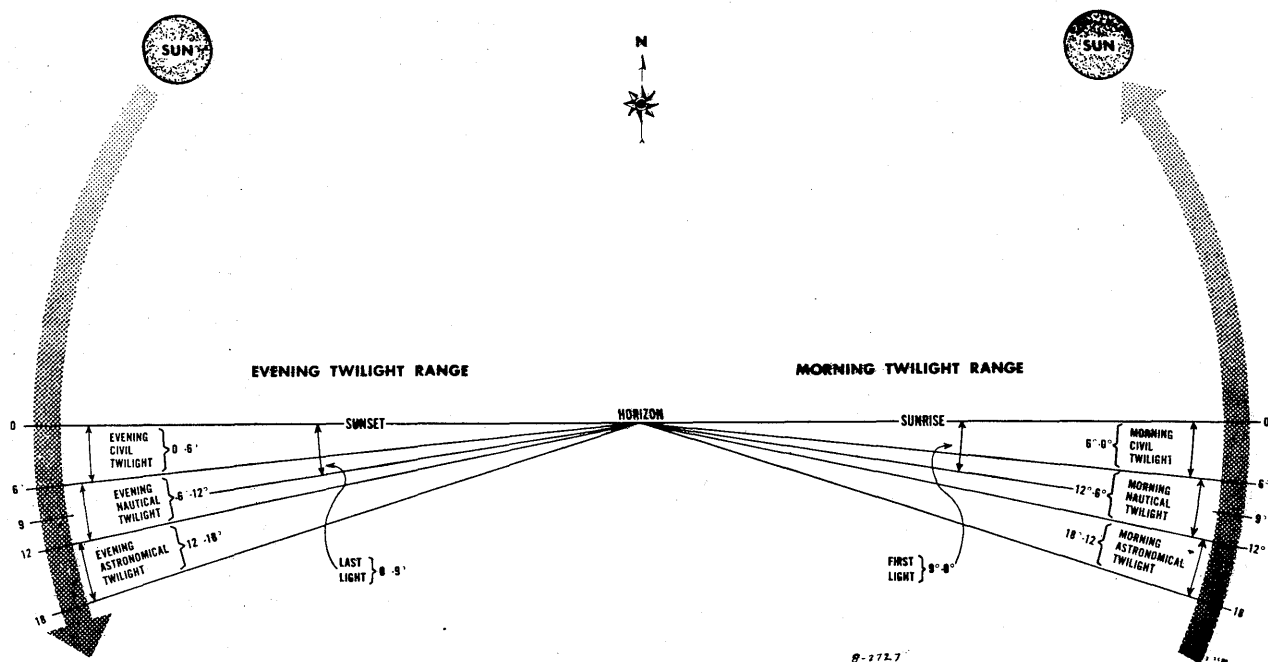
(b) Nautical twilight provides enough illumination to carry on most types of ground movement without difficulty and approaches conditions expected under full light of day. Vision is limited to 400 yards or less. For military purposes, during the nautical periods weapons can be employed within the range of vision stated and daylight calculations relative to movement will apply, including restrictions on such movement. Bomb loading and repair work cannot be carried on without the use of artificial light.

(c) Civil twilight affords sufficient light to carry on normal day activities. This period is the earliest or latest that provides sufficient natural illumination of targets to allow efficient observed artillery fire or day bombing.

(d) The above disregards weather and local surroundings (*i* below).

(2) Except for high latitudes, values for the approximate durations of astronomical, nautical, and civil twilights may be considered equal.

(3) *First light* and *last light*, terms used by the armed forces of the United Kingdom, include a slightly greater period of twilight than defined by civil twilight.



Note: Degrees refer to center of sun below horizon.

Twilight factors.

g. Moonlight. For astronomical twilight and solar darkness, periods of moonlight and dim moonlight are shown on the lower diagram. During the period of *moonlight*, the intensity of light will vary between the brightness of the full moon at zenith and about one-third of this value. During the period of *dim moonlight*, the intensity varies from about one-third to one-tenth of the brightness of full moon at zenith.

h. Moon's Phases. The phases of the moon are shown below the day on which they occur.

i. Effect of Weather on Light. Weather has been disregarded in these calculations. Smudge, fog, clouds, refraction, reflection, and precipitation affect the degree of illumination. These factors can be included in the calculations by means of experience tables compiled in the area over a period of time and from meteorological forecasts for the area only.

j. Diagram of Tides, Sunlight, and Moonlight.

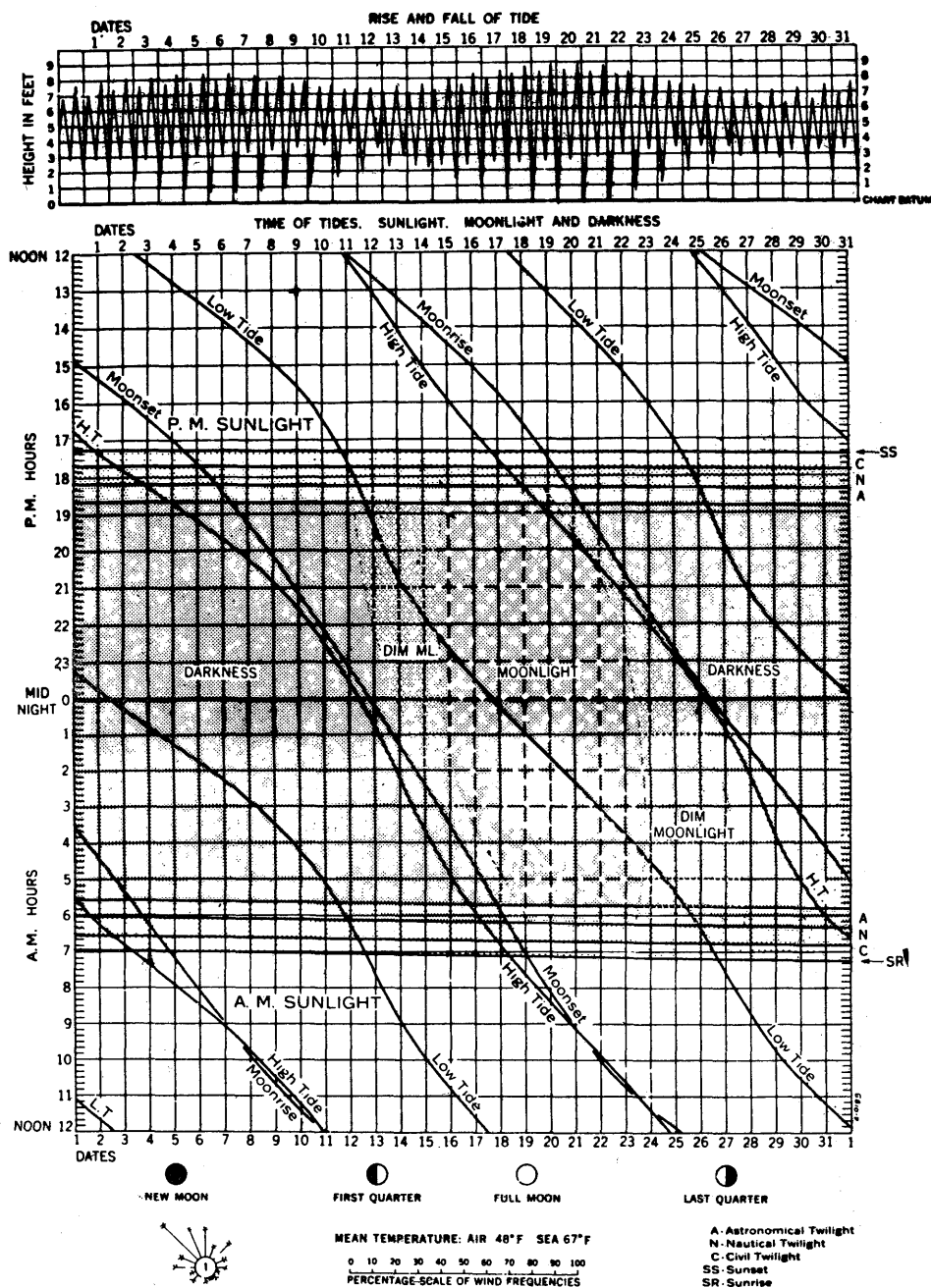
KAGOSHIMA—WAN, KYUSHU *

Lat $31^{\circ} 30' N.$, Long $130^{\circ} 40' E.$

DECEMBER 1945

Time Meridian: $135^{\circ} E.$

Sunlight and Moonlight Data Computed for Lat $31^{\circ} 30' N.$, Long $130^{\circ} 40' E.$



*This diagram, with the changes indicated, is also applicable to the following places:
TOMARI URA.—Add 10 minutes to times of high and low tides, subtract $\frac{1}{2}$ foot from heights of high tides.
ODOMARI WAN.—Subtract 25 minutes from times of high and low tides, subtract 1 foot from heights of high tides.

CHAPTER 4

OPERATIONS

Section I. TROOP PLANNING

4.1. General

a. The number and type of units to be employed in a given operation are determined by the mission; the character, disposition, and capabilities of the enemy; the terrain and climate; the availability of troops and/or units; the availability of transportation; and the availability of supplies and equipment.

b. *Basic Steps in Troop Requirements Planning.*

- (1) The following general steps are essential to the accomplishment of sound troop requirements planning:
 - (a) Determination of the functions or tasks to be performed.
 - (b) Determination of quantitative workload.
 - (c) Selection of type of operating unit, with capability required.
 - (d) Calculation of number of operating units required.
 - (e) Provision for command and control.
- (2) The accomplishment of the steps listed in (1) above requires a detailed study of the overall mission by each member of the staff in light of his responsibilities and the factors which affect the accomplishment of the mission.

c. *Planning Procedures.* Troop requirements planning passes through three phases—*estimation*, *calculation*, and *modification*. The first phase, particularly in the case of the establishment of a new theater, must be accomplished with few, if any, tangible figures. Each successive phase is developed with more concrete and accurate data than the preceding one, until a balanced, sound troop list is evolved.

- (1) *Phase I planning—estimation.* The initial step in the development of troop requirements must be accomplished with little specific data—often no more than a brief statement of the overall strength of the force to be employed or the number of divisions around which it is to be built. Each planner

must employ broad experience factors, such as division and wing slice, troop density, equipment density, replacement and consumption factors, and similar information. For example, when the total troop strength is unknown, it can be estimated by using appropriate division and wing slices. From this figure, and from basic vehicle density factors, the number of vehicles in the force can be estimated. Other data are derived in a similar fashion. The margin of error will depend to a great degree on the accuracy of factors employed. Factors representing best available experience should be used, and the planner is cautioned against changing factor values unless he has the experience and background to make such changes valid.

- (2) *Phase II planning—calculation.*

- (a) Phase II planning begins when phase I estimates are received from all arms and services in the form of initial tentative troop lists. Troop strengths and equipment lists for the force can be derived from these initial lists, which should be more accurate than the estimates used to initiate planning in phase I. The margin of error between the initial tentative lists and those finally accepted will depend not only upon the adequacy of the planning factors and guidance available to the troop requirement planners, but also upon the experience, aptitude, and judgment of the individual planner. Technical service troop planning officers should carefully scrutinize the lists of the arms and services to determine whether they contain errors. Branch strengths in relation to the total force strength should be

compared with currently accepted percentages and should be challenged if they deviate significantly.

- (b) When the consolidated initial troop list is available, each planner should review the list and decide, based on the new information from the consolidated list, whether his next revision will increase or decrease and to what extent. The predictions of each planner should be appraised for accuracy, and a recalculation of the first revised troop list should be made as a result of these predictions. This information should then be furnished all planners so that each will be aware of direction and limits of changes which are to be applied.
 - (c) When this information is available, phase II planning continues with the preparation of revised estimates by each branch representative. The division slice and other factors suitable only for initial estimation are discarded in favor of actual (or adjusted) figures extracted from the initial lists. Several revisions may be necessary before all arms and services lists are brought into balance with each other. Intelligent adjustment and careful prediction at each successive planning stage will reduce the number of revisions necessary to arrive at a calculated balanced troop list to complete phase II.
- (3) *Phase III planning—modification.*
- (a) The consolidated troop list produced in phase II will provide a balanced force, each element of which is capable of performing its mission without augmentation. Modifications, adaptations, or alterations dictated by policy, by command direction, or by conditions peculiar to the theater under consideration are applied in phase III, if not already taken into consideration in phase I or phase II.
 - (b) Substitution of indigenous labor for military personnel should be made

at this stage. At the same time, lists of class IV equipment to be issued for the use of the indigenous labor forces should be prepared.

- (c) The substitution of indigenous labor for military personnel will immediately throw the troop list out of balance, and it may require several successive revisions such as those made in phase II to restore it to balance. Various services will be affected differently. The impact on ordnance will be relatively small, since the equipment density will not change significantly; but the impact upon the medical troop list is great, since medical service is provided primarily on the basis of military strength. Other services will be affected to greater or less extent depending on the change in military strength and equipment required.
- (d) Since substitution of indigenous labor in phase III will cause an imbalance and make additional revisions necessary, consideration should be given to effecting the substitution earlier in the planning. This would simplify matters for services, such as medical, interested primarily in military strengths; but it will complicate matters for those services which must prepare lists of class IV equipment for the labor force. If the labor force is planned concurrently with the military forces, the class IV equipment lists must be included in each step and revised accordingly. This will complicate and delay the steps in planning for all services and may introduce greater degrees of error in each step. The decision as to which procedure to follow will be made by the chief of the planning group, but the various technical service representatives should present the advantages and disadvantages of each method and make an appropriate recommendation in each case. It is desirable to establish 100 percent military troop lists against

which augmentations and comparisons may be made.

- (e) Arbitrary personnel ceilings are frequently imposed upon the technical and administrative services. These should not be applied until phase III, since the reduction in strength may not be proportional for all services or for all units within a service. If the full military strength required to accomplish a mission is known, the effects of a reduced strength can be adequately appraised and reported to the head of the planning staff and force commander.
- (f) Final distribution of troops by zone or area and determination and location of depots and other major installations are accomplished in phase III. If these are done tentatively for each troop list prepared in phases I and II, the final determination is simplified, since each planner becomes increasingly aware of the deployment of the troops of other arms and services throughout the theater and progressively adjusts his own distribution to meet the probable load.

4.2. Troop Requirements, Typical Field Army

a. The tables shown in this paragraph indicate the numbers and types of combat and service units not organic to the divisions which might be found in a typical field army under average conditions. Such an army is presumed

to have 3 corps of 3 infantry divisions and 1 armored division each. The table of organization and equipment is shown when the unit is a current type. When the unit is a proposed type, the table of organization and equipment so indicates. In the application of these tables to a specific situation, modifications and adjustments must be made for variations in the composition or size of the force and any peculiarities of the particular situation.

b. The diagrams show the schematic layout of the units and the general areas of their operation. They are not intended to show the attachment or assignment of units to corps and divisions except in a very general way, and they are not intended to show the exact location of units.

c. Armored Units—Numbers and Types.

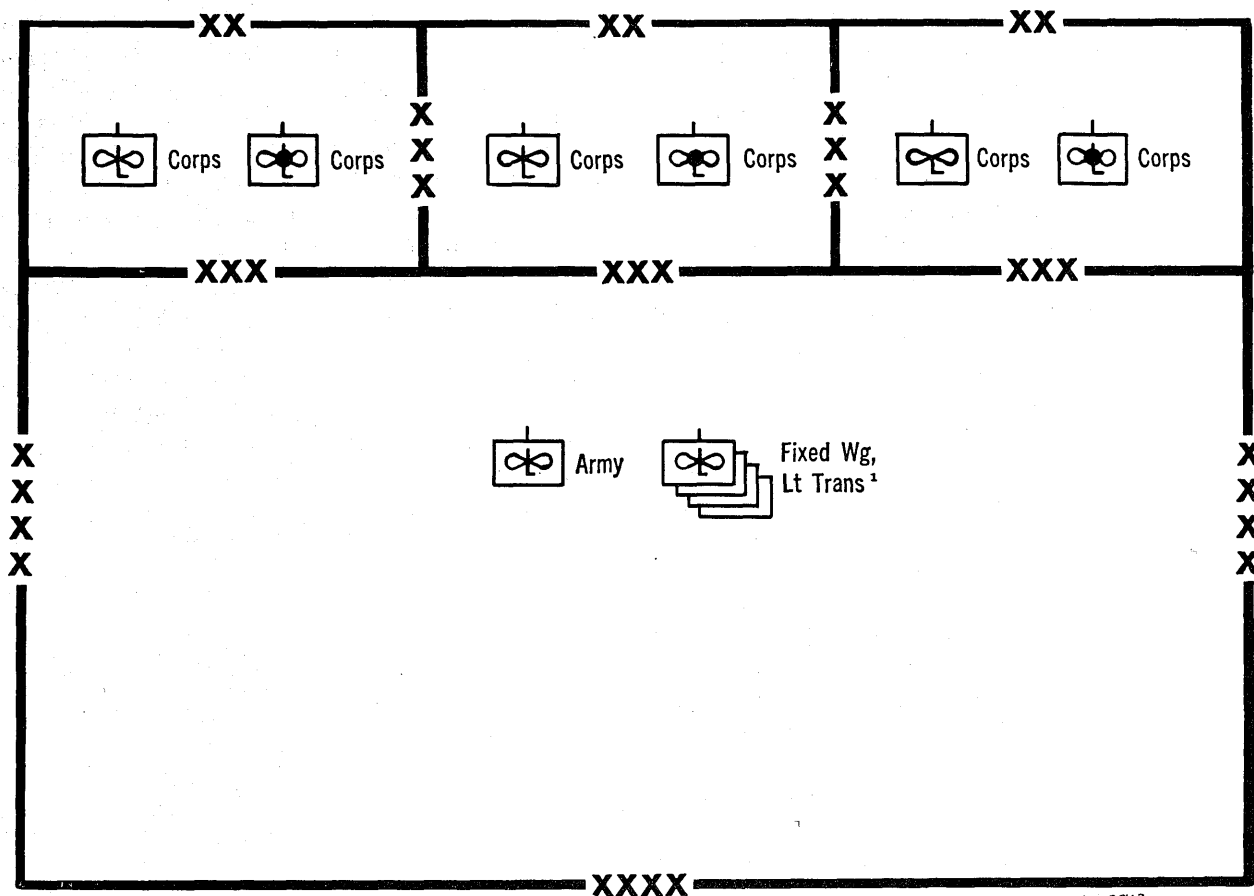
	1	2	3	4	5
	Unit	TOE	Corps	Army	Total army
1					
2	Armd cav regt.....	17-51R	1	2	5
3	HQ & HQ co, armor gp....	17-32R	1	---	3
4	Tk bn, 90-mm gun.....	17-25C	3	---	9

d. Army Aviation Units.

(1) Numbers and types—Army aviation units.

	1	2	3	4	5
	Unit	TOE	Corps	Army	Total army
1					
2	Corps arty avn co.....	1-117D	1	---	3
3	Corps avn co.....	1-127D	1	---	3
4	Army avn co.....	1-137D	---	1	1
5	Avn co, fxd wg, light transport.....	1-107D	---	4	4

(2) Schematic diagram—Army aviation units.



¹ For operation, normally assigned one per headquarters and headquarters company, transportation aircraft battalion. (See par. p(2) below.)

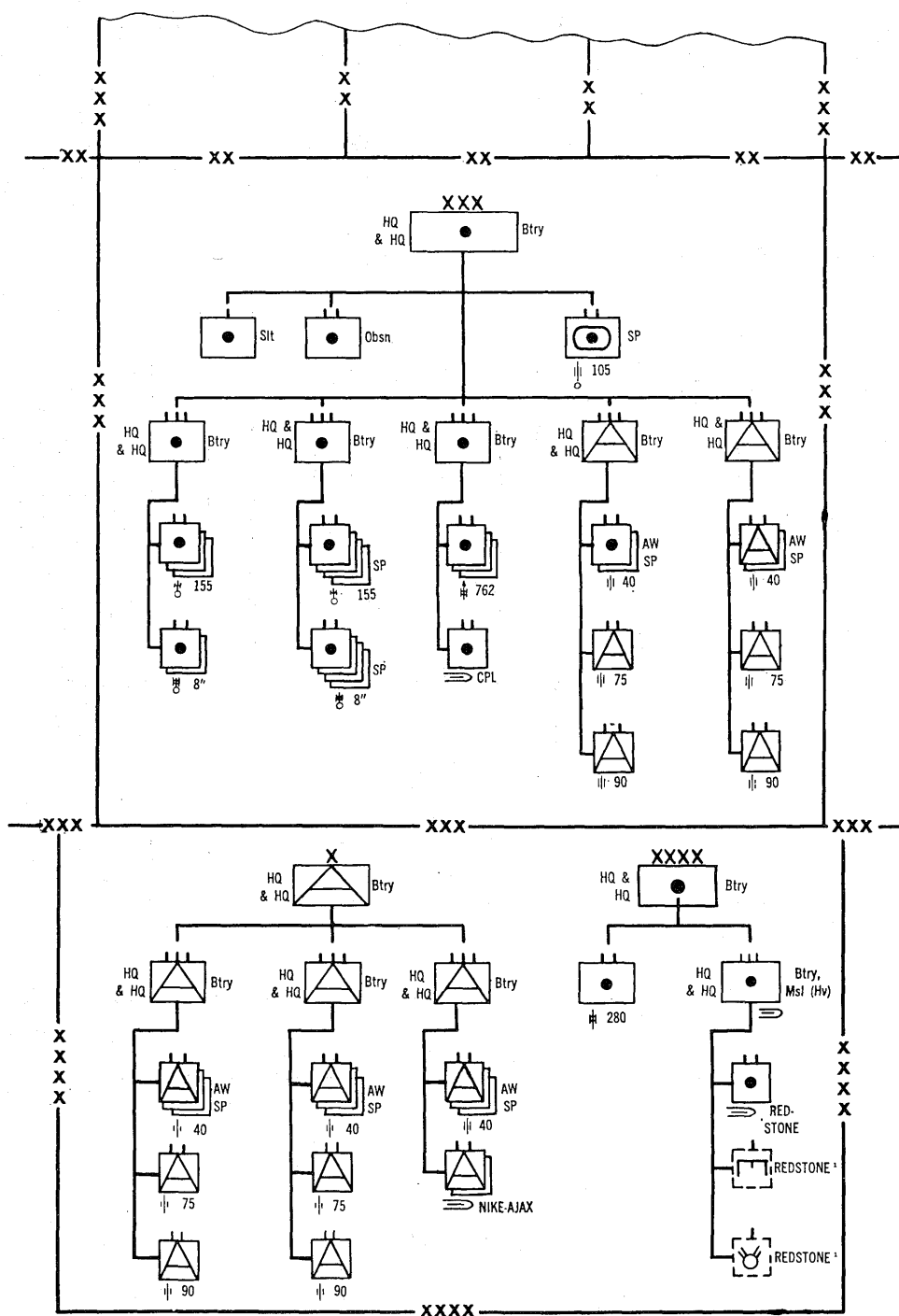
e. Artillery Units.

(1) Numbers and types—artillery units.

	1	2	3	4	5
	Unit	TOE	Corps	Army	Total army
1					
2	HQ & HQ btry, army arty...	6-601T		1	1
3	HQ & HQ btry, corps arty...	6-501C	1		3
4	HQ & HQ btry, FA gp...	6-401C	3		9
5	HQ & HQ btry, FA msl gp (hv).....	6-611 (Tent)		1	1
6	FA obsn bn.....	6-575C	1		3
7	FA btry, slt.....	6-558C	1		3
8	HQ & HQ btry, AAA bde, mbl.....	44-101C		1	1
9	HQ & HQ btry, AAA gp, mbl.....	44-12C	2	3	9
10	ADA msl bn, NIKE-AJAX.....	44-145D		2	2
11	ADA AW bn, SP.....	44-85D	4	9	21

	1	2	3	4	5
	Unit	TOE	Corps	Army	Total army
12	AAA bn, 90-mm gun, mbl...	44-15C	2	2	8
13	ADA gun bn, SKY-SWEEPER.....	44-35D	2	2	8
14	FA bn, 105-mm how, SP, armd.....	6-315C	1		3
15	FA bn, 155-mm how, towed...	6-135C	3		9
16	FA bn, 155-mm how, SP, armd.....	6-325C	4		12
17	FA how bn, 8-in., towed.....	6-415D	2		6
18	FA how bn, 8-in., SP.....	6-415D	4		12
19	FA bn, 280-mm gun.....	6-535C		1	1
20	FA rkt bn, 762-mm rkt, SP...	6-525C	3		9
21	FA msl bn, CORPORAL.....	6-545D	1		3
22	FA msl bn, REDSTONE.....	6-635D		1	1

(2) Schematic diagram—artillery units.



¹Organic to field artillery missile group (heavy).

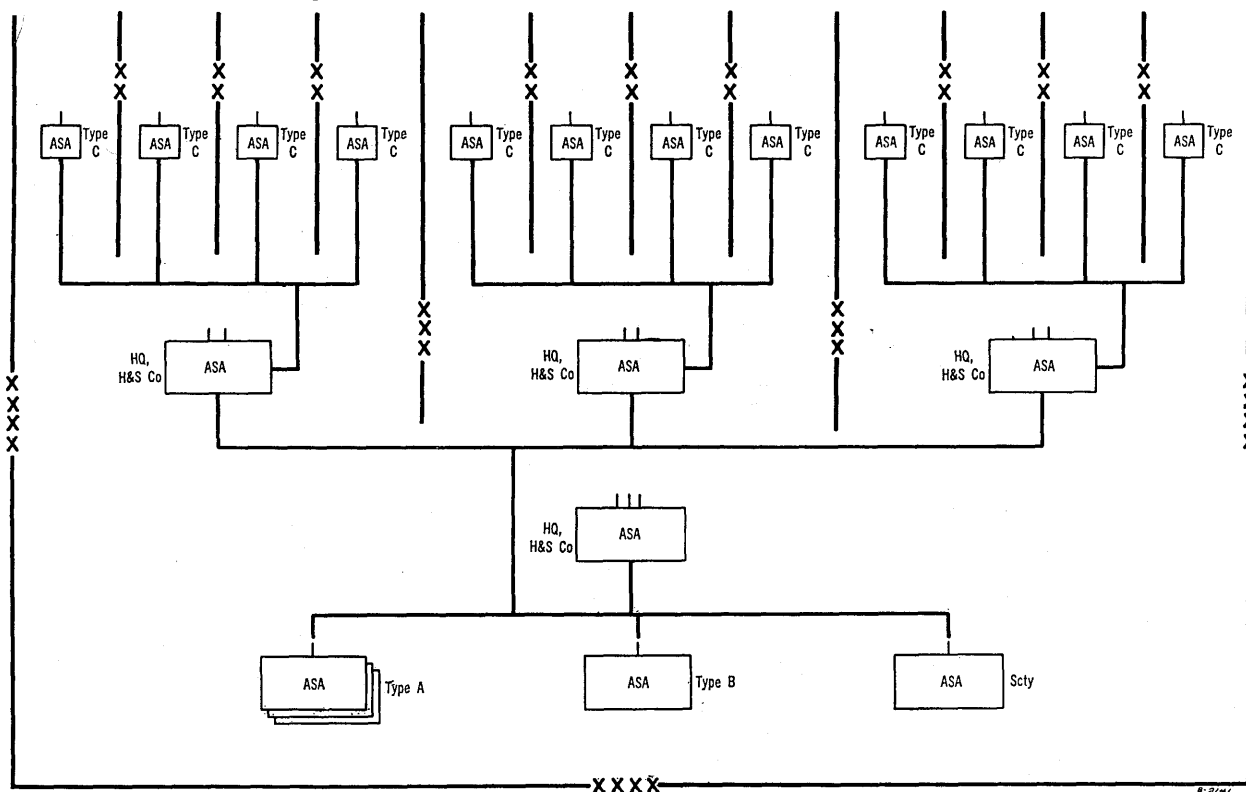
f. Army Security Agency Units.

(1) Numbers and types—Army Security Agency units.

	1	2	3	4	5
	Unit	TOE	Corps	Army	Total army
1	HQ, H & S co, ASA gp-----	Tent	-----	1	1
2	ASA co (type A)-----	Tent	-----	3	3
3	ASA co (type B)-----	Tent	-----	1	1
4	ASA co (scty)-----	Tent	-----	1	1
5	HQ, H & S co, ASA bn-----	Tent	1	-----	3
6	ASA co (type C)-----	Tent	14	-----	12

¹ One per division.

(2) Schematic diagram—Army Security Agency units.



g. Chemical Units.

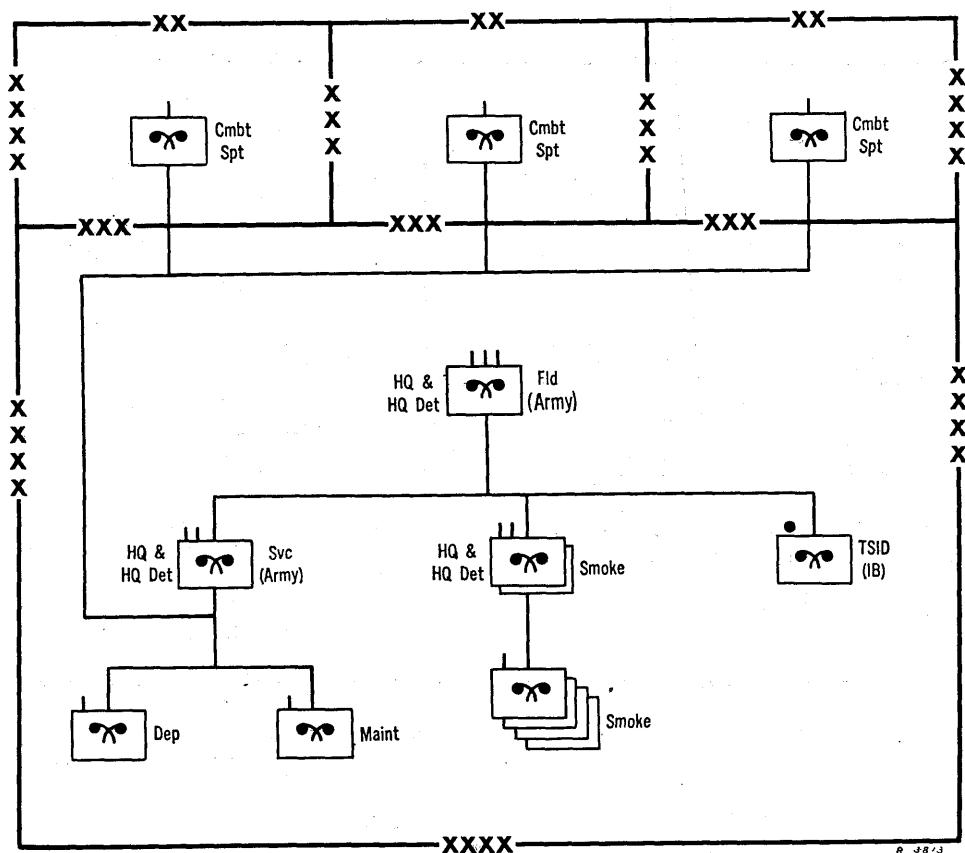
(1) Numbers and types—chemical units.

	1	2	3
	Unit	TOE	Total army
1	HQ & HQ det, cml gp (fld army) ¹ -----	3-32D	1
2	HQ & HQ det, cml genr smoke bn-----	3-266D	2
3	Cml smoke genr co-----	3-267D	8
4	HQ & HQ det, cml bn (svc) ² ---	3-36D	1
5	Cml maint co-----	3-47D	1
6	Cml pep co-----	3-67D	1
7	Cml tech intel det (team IB)---	3-500D	1
8	Cml co, cmbt spt-----	3-7D	3

¹With augmentation sections; for command of 3 to 7 battalions.

²For command of 3 to 7 companies such as chemical maintenance, chemical depot, and chemical combat support companies.

(2) Schematic diagram—chemical units.



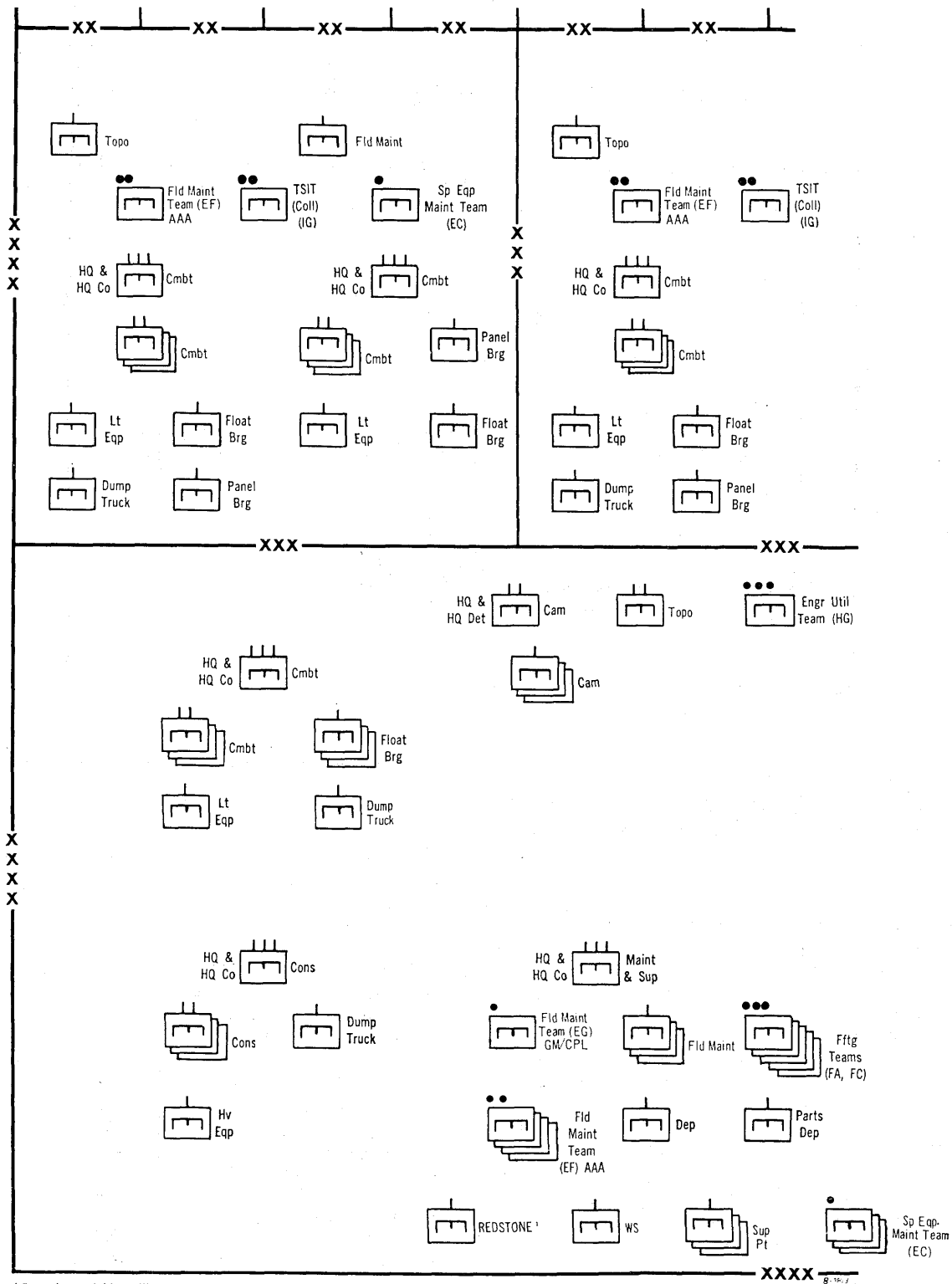
h. Engineer Units.

(1) Numbers and types—engineer units.

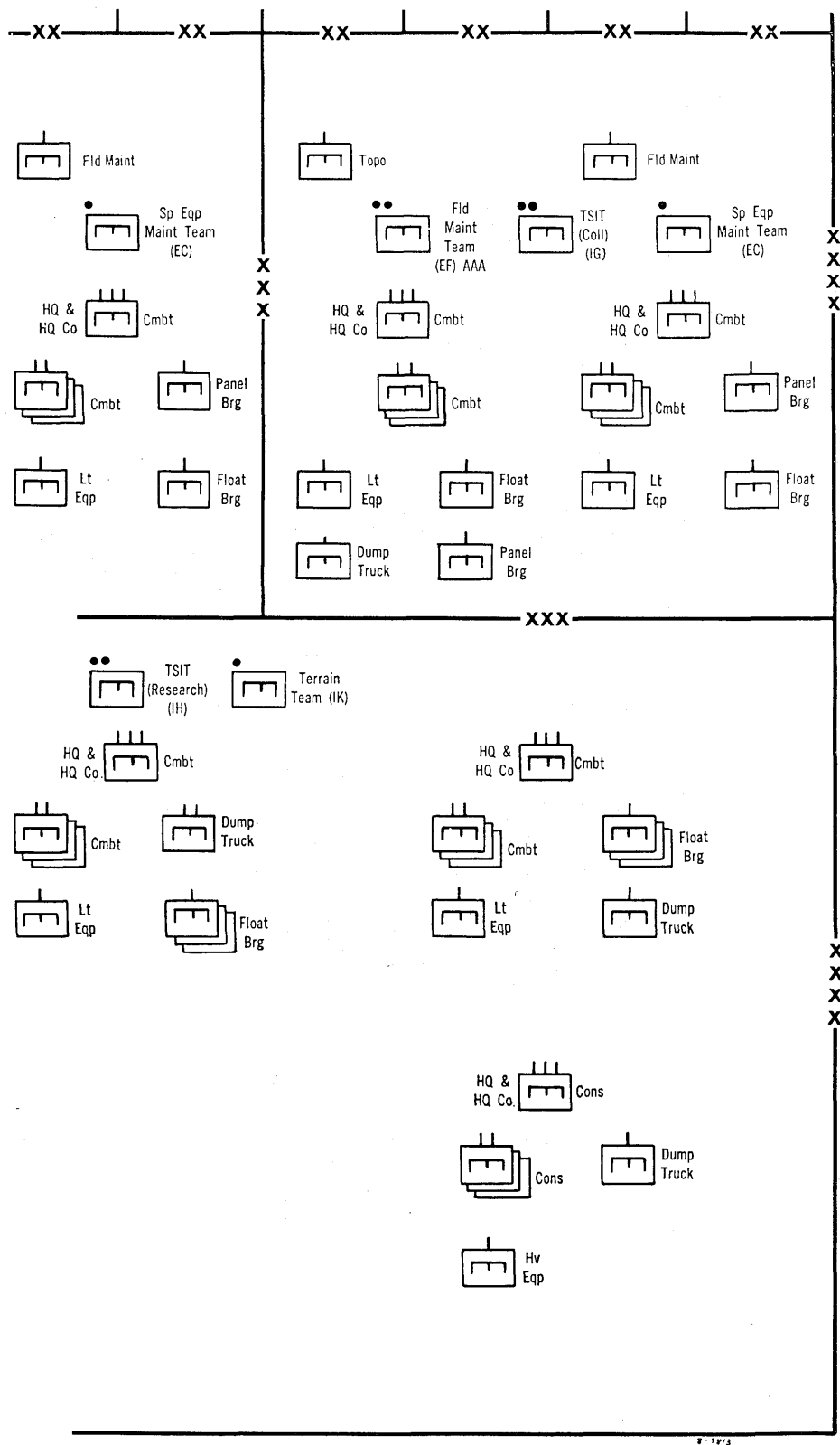
1	2	3	4	5
Unit	TOE	Corps	Army	Total army
2 HQ & HQ co, engr cmbt gp	5-192C	2	3	9
3 Engr cmbt bn, army	5-35R	6	9	27
4 HQ & HQ co, engr cons gp	5-312R	---	2	2
5 Engr cons bn	5-315R	---	6	6
6 Engr dp trk co	5-324R	1	5	8
7 Engr hv eqp co	5-328R	---	2	2
8 Engr lt eqp co	5-367C	2	3	9
9 Engr float brg co	5-138D	2	9	15
10 Engr pnl brg co	5-137C	2	0	6
11 HQ & HQ det, engr cam bn	5-96R	---	1	1
12 Engr cam co	5-97R	---	3	3
13 Engr topo bn, army	5-55R	---	1	1
14 Engr topo co, corps	5-167C	1	---	3
15 HQ & HQ co, engr maint & sup gp	5-262R	---	1	1
16 Engr dep co	5-267D	---	1	1

1	2	3	4	5
Unit	TOE	Corps	Army	Total army
17 Engr sup pt co	5-48R	---	3	3
18 Engr fld maint co	5-157C	1	3	6
19 Engr WS co	5-67R	---	1	1
20 Engr parts dep co	5-279D	---	1	1
21 Engr ffig teams (FA, FC)	5-500C	---	5	5
22 Engr sp eqp maint team (EC)	5-500C	1	3	6
23 Engr tech intel coll team (IG)	5-500C	1	---	3
24 Engr tech intel research team (IH)	5-500C	---	1	1
25 Engr util team (HG)	5-500C	---	1	1
26 Engr terrain team (IK)	5-500C	---	1	1
27 Engr fld maint team GM/CPL (EG)	5-500C	---	1	1
28 Engr fld maint team AAA (EF)	5-500C	1	4	7
29 Engr co, REDSTONE	5-464C	---	1	1

(2) Schematic diagram—engineer units.



¹Organic to field artillery missile group (heavy).



i. Infantry Units—Numbers and Types.

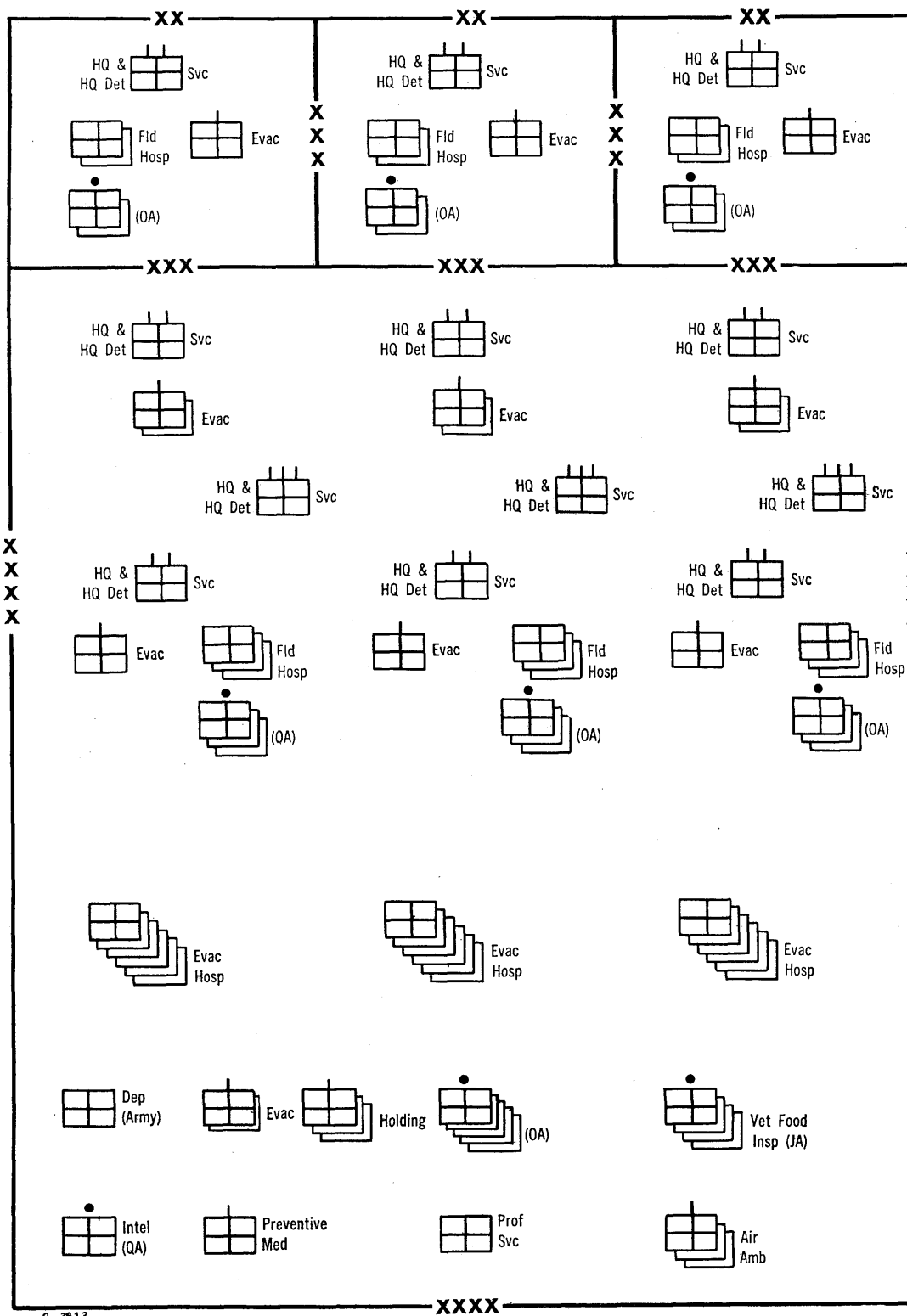
	1	2	3	4	5
	Unit	TOE	Corps	Army	Total army
1					
2	HQ & HQ co, inf bde, sep--	7-52D	----	1	1
3	Inf BG, sep-----	7-11T	1	3	6
4	Pathfinder team, abn-----	7-168T	----	4	4

j. Medical Units.

(1) Numbers and types—medical units.

	1	2	3	4	5
	Unit	TOE	Corps	Army	Total army
1					
2	HQ & HQ det, med svc gp--	8-22D	1	----	3
3	HQ & HQ det, med svc bn---	8-26D	2	3	9
4	Med evac co-----	8-27D	3	4	13
5	Med holding co-----	8-57D	----	3	3
6	Air amb co-----	8-29D	----	3	3
7	Preventive med co-----	8-117D	----	1	1
8	Army med depot-----	8-667D	----	1	1
9	Fld hosp, 300-bed, mbl-----	8-510D	5	----	15
10	Evac hosp, 400-bed, smbl---	8-581D	5	3	18
11	HQ, professional svc (AG)---	8-500C	----	1	1
12	Surgical det (KA)-----	8-500C	4	8	20
13	Orthopedic det (KB)-----	8-500C	2	6	12
14	Maxillo-facial det (KD)---	8-500C	1	1	4
15	Neurosurgical det (KE)---	8-500C	1	1	4
16	Thoracic det (KF)-----	8-500C	2	----	6
17	Dental svc det (KJ)-----	8-500C	6	5	23
18	Dental prosthetic det, mbl (KK)-----	8-500C	1	2	5
19	Psychiatric det (KO)-----	8-500C	1	1	4
20	Vet food insp det, small (JA)	8-500C	----	4	4
21	Med det (OA)-----	8-500C	5	5	20
22	Med intel det (QA)-----	8-500C	----	1	1

(2) Schematic diagram—medical units.



8-3813

k. Military Intelligence Units.

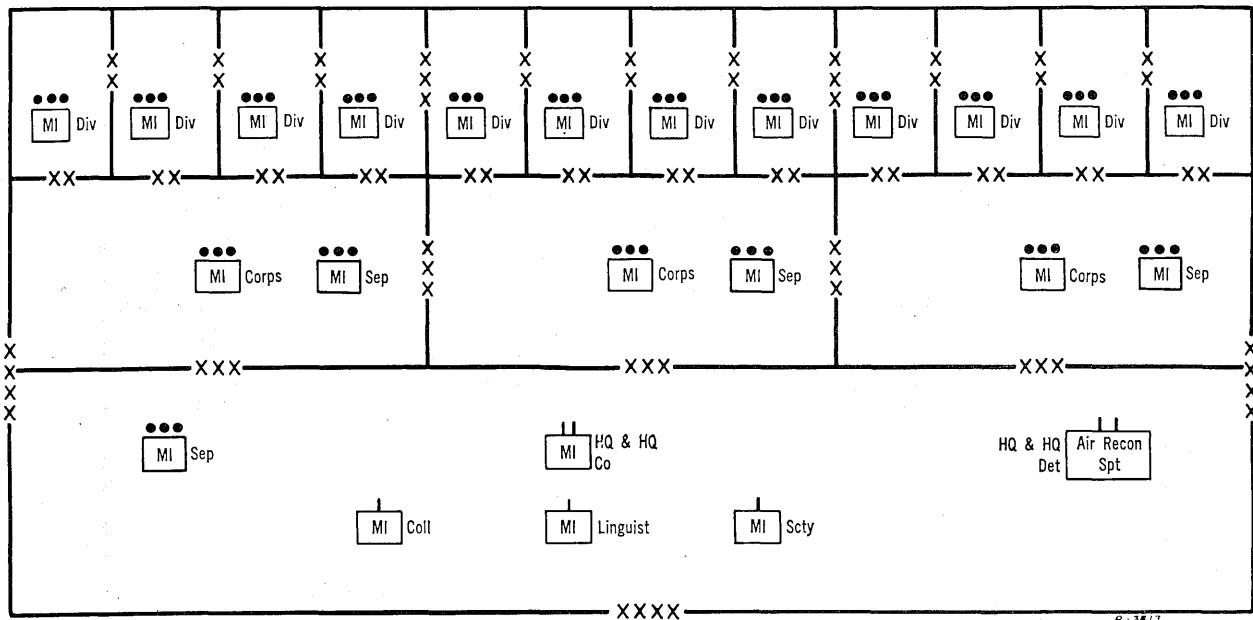
(1) Numbers and types—military intelligence units.

	1	2	3	4	5
1	Unit	TOE	Corps	Army	Total army
2	HQ & HQ co, MI bn, field army-----	30-161D	-----	1	1
3	MI coll co-----	30-191D	-----	1	1
4	MI linguist co-----	30-211D	-----	1	1
5	MI scety co-----	30-221D	-----	1	1
6	MI det, corps-----	30-181D	1	-----	3
7	MI det, div-----	30-171D	1 4	-----	12
8	MI plat, sep ² -----	30-6001D	1	1	4
9	Air recon spt bn-----	51-15C	-----	1	1

¹ One per division.

² Cells AB, 2FB, FI, FM, GF, GM.

(2) Schematic diagram—military intelligence units.

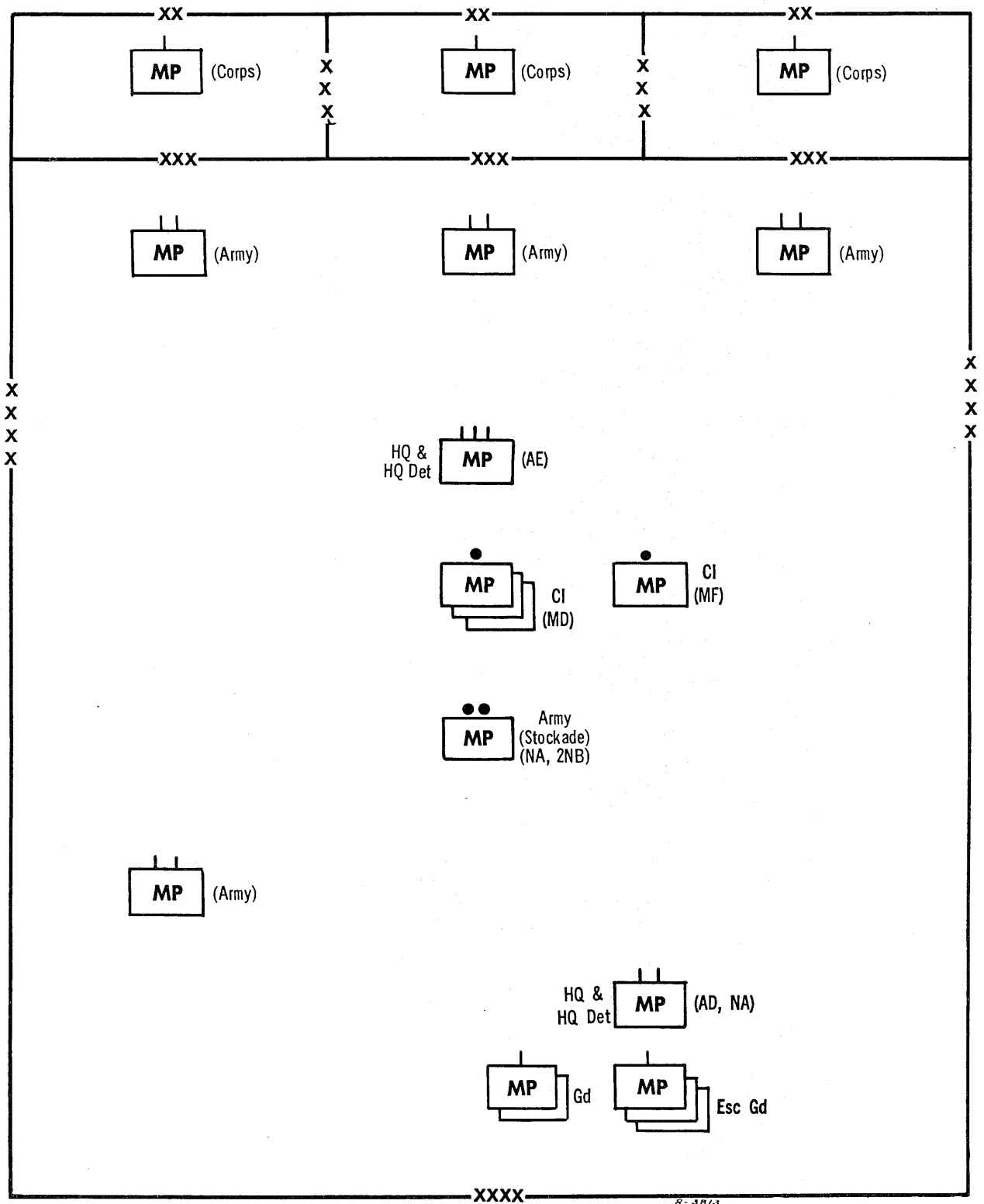


l. Military Police Units.

(1) Numbers and types—military police units.

	1	2	3	4	5
1	Unit	TOE	Corps	Army	Total army
2	HQ & HQ det, MP gp (AE)-----	19-500R	-----	1	1
3	MP bn, army-----	19-35R	-----	4	4
4	HQ & HQ det, MP bn (AD, NA)-----	19-500R	-----	1	1
5	MP co, corps-----	19-371D	1	-----	3
6	MP esc gd co-----	19-471D	-----	3	3
7	MP gd co-----	19-247C	-----	2	2
8	MP admin det (stockade) (NA, 2 NB)-----	19-500R	-----	1	1
9	MP det (CI) (MD)-----	19-500R	1	-----	3
10	MP det (CI) (MF)-----	19-500R	-----	1	1

(2) Schematic diagram—military police units.



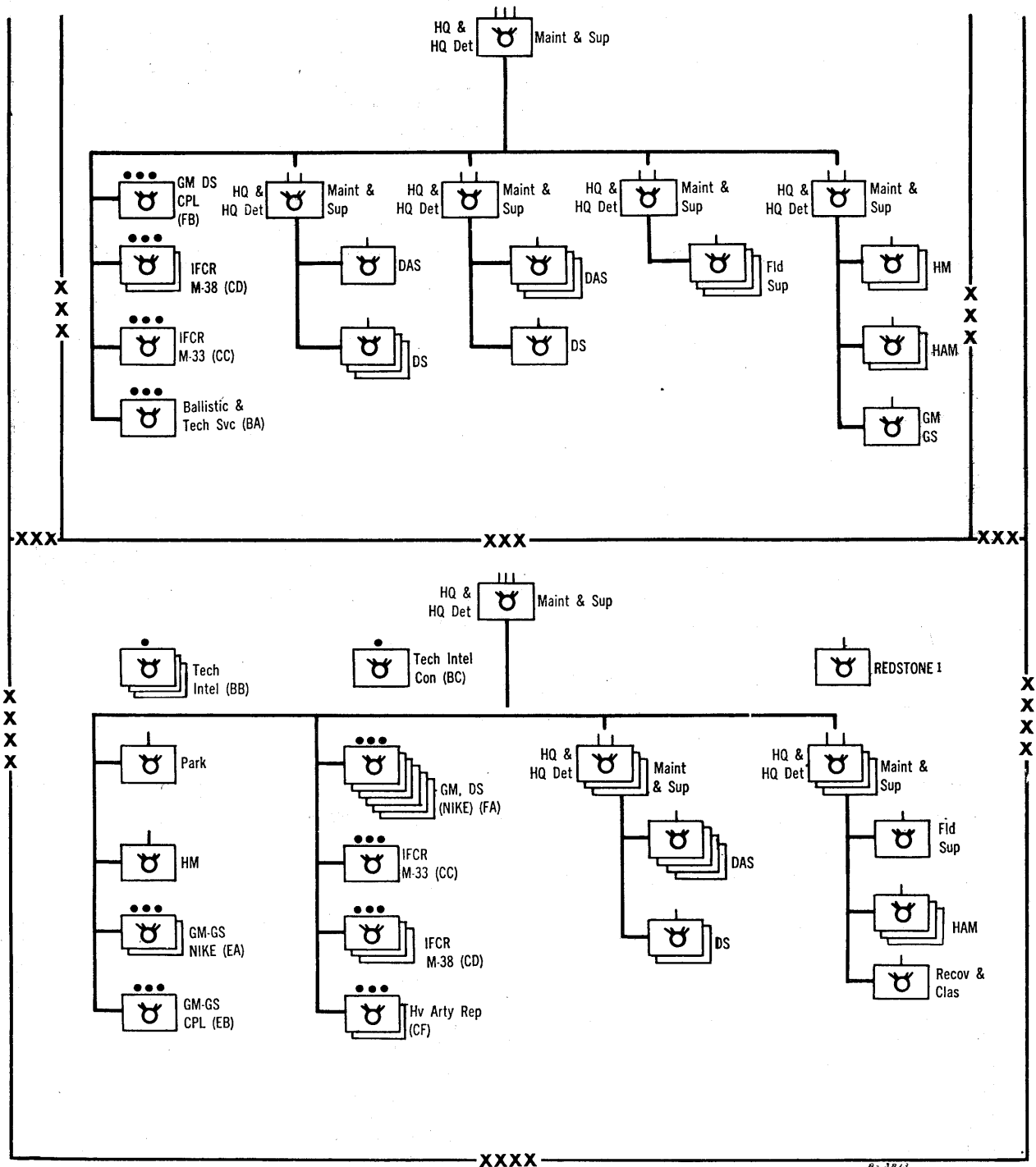
m. Ordnance Units.

(1) Numbers and types—ordnance units.

	1	2	3	4	5
	Unit	TOE	Corps	Army	Total army
2	HQ & HQ det, ord gp, maint & sup-----	9-12D	----	4	4
3	HQ & HQ co, ord gp, ammo-----	9-22 (Tent)	----	1	1
4	HQ & HQ det, ord bn, ammo-----	9-86 (Tent)	----	4	4
5	HQ & HQ det, ord bn (maint & sup)-----	9-76R	----	18	18
6	Ord co, DS-----	9-7R	----	18	18
7	Ord co, direct autmv spt-----	9-127R	----	24	24
8	Ord co, hv maint-----	9-9D	----	7	7
9	Ord co, hv autmv maint-----	9-197D	----	15	15
10	Ord co, fld sup-----	9-57R	----	12	12
11	Ord co, recov and clas-----	9-167R	----	3	3
12	Ord co, park-----	9-137D	----	1	1
13	Ord co, ammo, army-----	9-17 (Tent)	----	12	12
14	Ord co, GM, sp wpn, & sety, DS-----	9-47 (Tent)	----	4	4
15	Ord co, GM, sp wpn, & sety, GS-----	9-87 (Tent)	----	1	1
16	Ord co, REDSTONE-----	9-217 (Tent)	----	1	1
17	Ord co, GM, GS-----	9-227 (Tent)	----	3	3
18	Ord 2et, GM, DS (FA) (NIKE)-----	9-510R	----	6	6
19	Ord det, GM, DS (FB) (CPL)-----	9-510R	----	3	3
20	Ord det, EOD (AA)-----	9-510R	2	3	9
21	Ord det, EOD aug (AB)-----	9-510R	----	2	2
22	Ord det, EOD con (AC)-----	9-510R	----	2	2
23	Ord det, ballistic & tech svc (BA)-----	9-510R	1	----	3
24	Ord det, tech intel (BB)-----	9-510R	----	3	3
25	Ord det, tech intel con (BC)-----	9-510R	----	1	1
26	Ord det, IFCR, M-33 (CC)-----	9-510R	----	4	4
27	Ord det, IFCR, M-38 (CD)-----	9-510R	2	3	9
28	Ord det, hv arty mtl rep (CF)-----	9-510R	----	2	2
29	Ord det, GM, GS, NIKE (EA)-----	9-500D	----	2	2
30	Ord det, GM, GS, CPL (EB)-----	9-500D	----	2	2

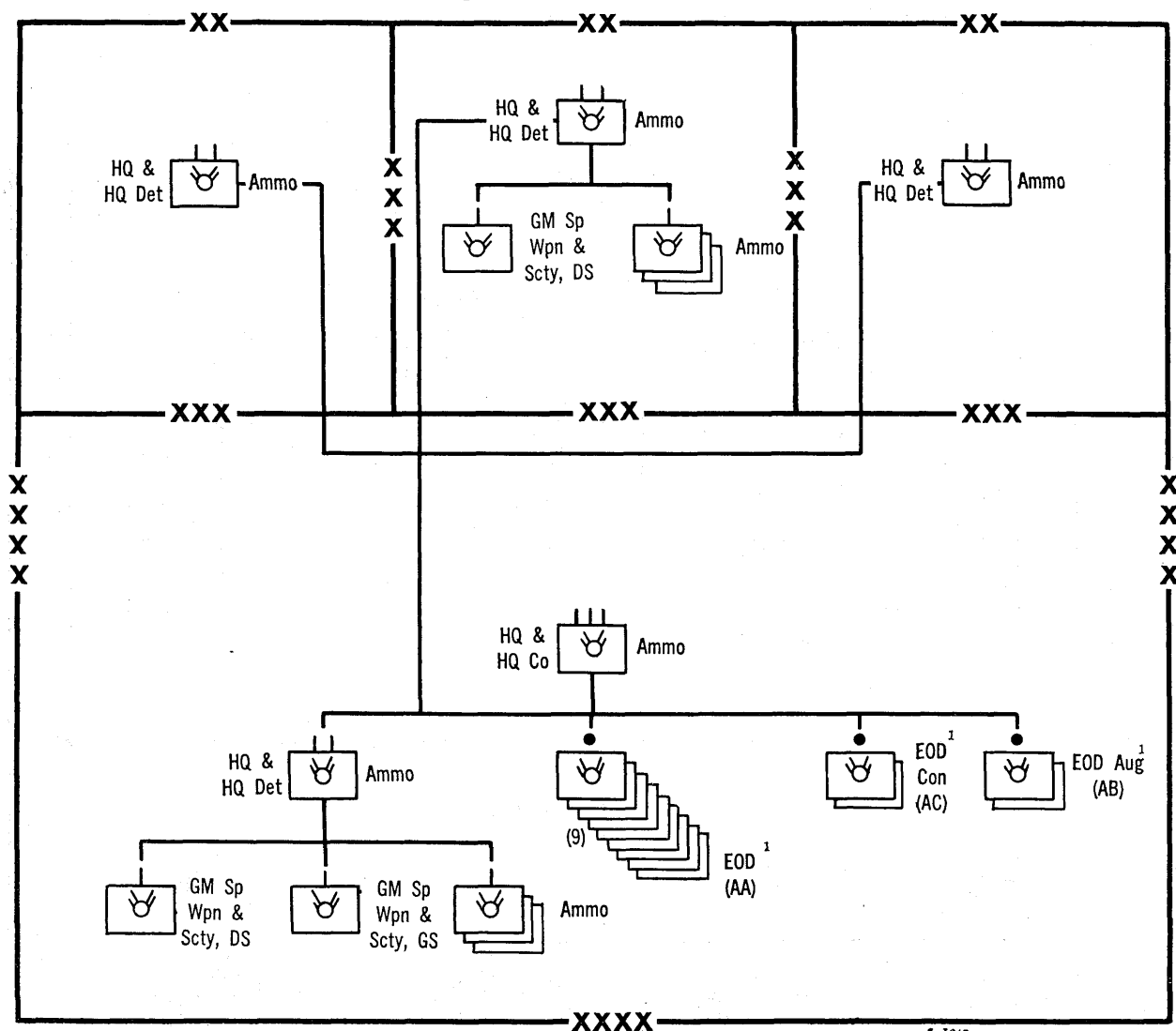
(2) Schematic diagram—ordnance units.

(a) General supply and maintenance.



1 Organic to field artillery missile group (heavy).

(b) Ordnance ammunition supply.



1 Under direct operational control of the army ordnance officer.

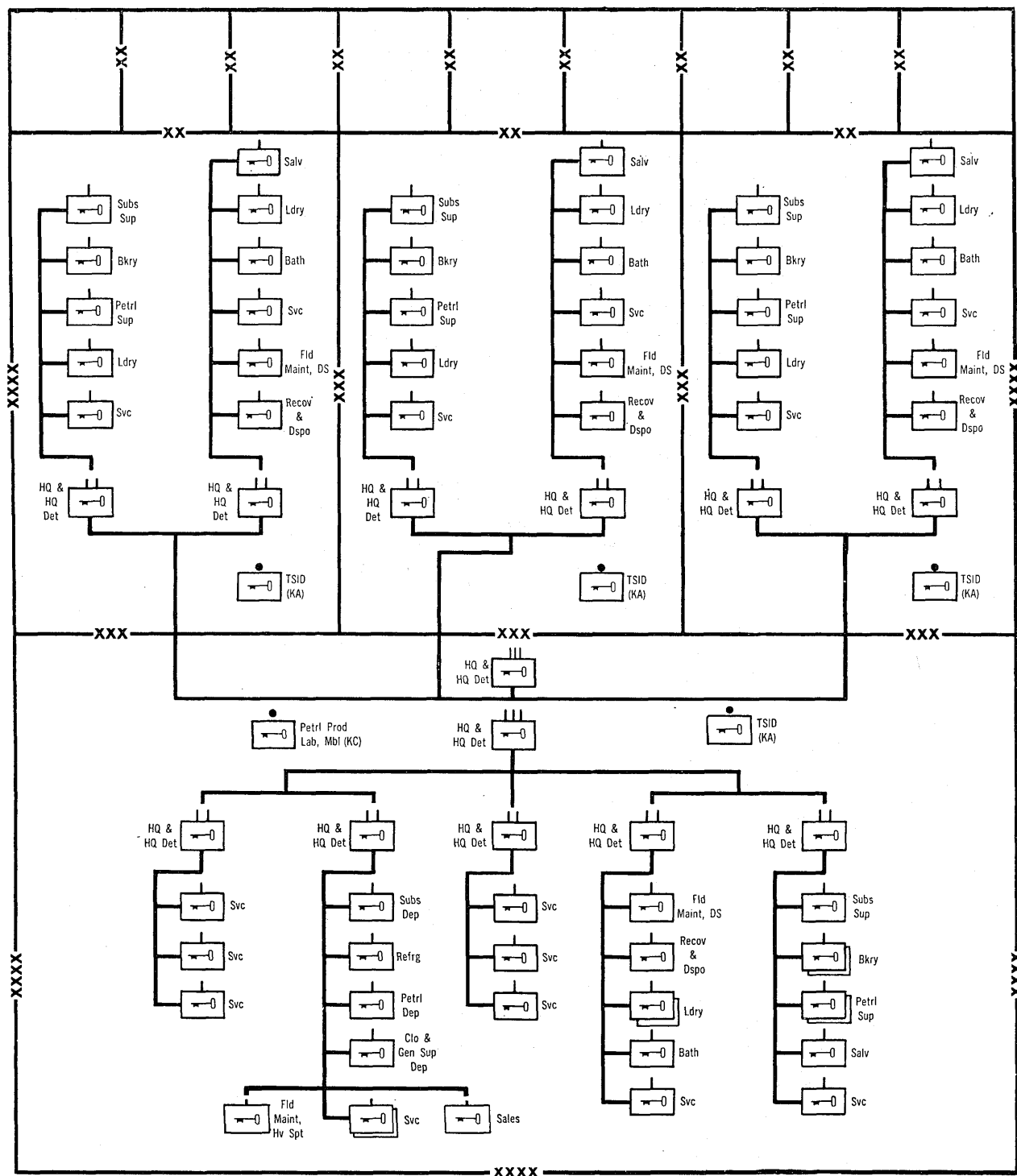
n. Quartermaster Units.

(1) Numbers and types—quartermaster units.

	1	2	3	4	5
	Unit	TOE	Corps	Army	Total army
1					
2	HQ & HQ det, QM gp.....	10-22R		2	2
3	HQ & HQ det, QM bn.....	10-536R		11	11
4	QM bkry co.....	10-147R		5	5
5	QM clo & gen sup dep co.....	10-227D		1	1
6	QM sub dep co.....	10-357C		1	1
7	QM ldry co.....	10-167R		8	8
8	QM refrg co.....	10-247C		1	1
9	QM sales co.....	10-157R		1	1
10	QM svc co.....	10-67C		16	16

	1	2	3	4	5
	Unit	TOE	Corps	Army	Total army
1					
11	QM petrl sup co.....	10-77R		5	5
12	QM petrl dep co.....	10-377C		1	1
13	QM bath co, smbl.....	10-257R		4	4
14	QM recov and dspo co.....	10-297D		4	4
15	QM salv co.....	10-187D		4	4
16	QM subs sup co.....	10-197C		4	4
17	QM fld maint co, DS.....	10-347D	3	1	4
18	QM fld maint co, hv spt.....	10-348D		1	1
19	QM tech intel det (KA).....	10-500R	1	1	4
20	QM petrl prod lab, mbl (KC).....	10-500R		1	1

(2) Schematic diagram — quartermaster units.



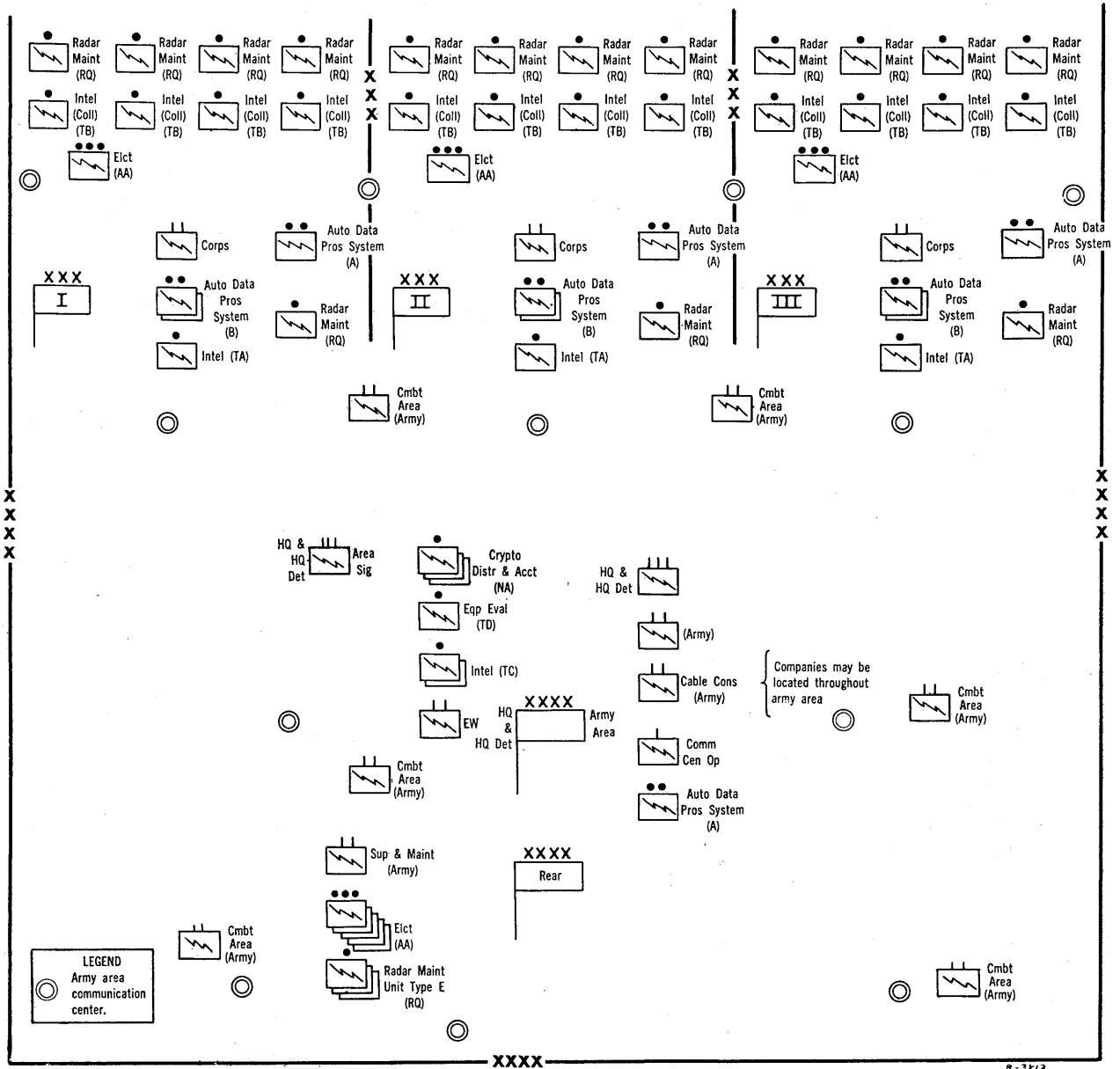
o. Signal Corps Units.

(1) Numbers and types—signal units.

1	1	2	3	4	5
	Unit	TOE	Corps	Army	Total army
2	HQ & HQ det, sig gp-----	11-22D	----	1	1
3	HQ & HQ det, army area sig gp-----	11-32D	----	1	1
4	Sig bn, army-----	11-95 (Tent)	----	1	1
5	Sig bn, cmbt area, army----	11-85D	----	6	6
6	Sig bn, cable cons, army----	11-45 (Tent)	----	1	1
7	Sig co, comm cen op-----	11-137D	----	1	1
8	Sig bn, sup & maint, army--	11-155D	----	1	1
9	Sig bn, corps-----	11-15D	1	----	3
10	Sig bn, EW-----	11-65D	----	1	1
11	Sig plat, electronic (AAA)--	Tent	1	5	8
12	Sig det, auto data pros system (A)-----	Tent	1	1	4
13	Sig det, auto data pros system (B)-----	Tent	2	----	6
14	Sig det, crypto distr & acctg (NA)-----	11-500R	----	3	3
15	Sig det, eqp eval (TD)-----	11-500R	----	1	1
16	Sig det, radar maint unit, type E (RQ)-----	11-500R	----	18	18
17	Sig det, intel (TA)-----	11-500R	1	----	3
18	Sig det, intel coll (TB)-----	11-500R	14	----	12
19	Sig det, intel (TC)-----	11-500R	----	2	2

¹ One per division.

(2) Schematic diagram—signal units.



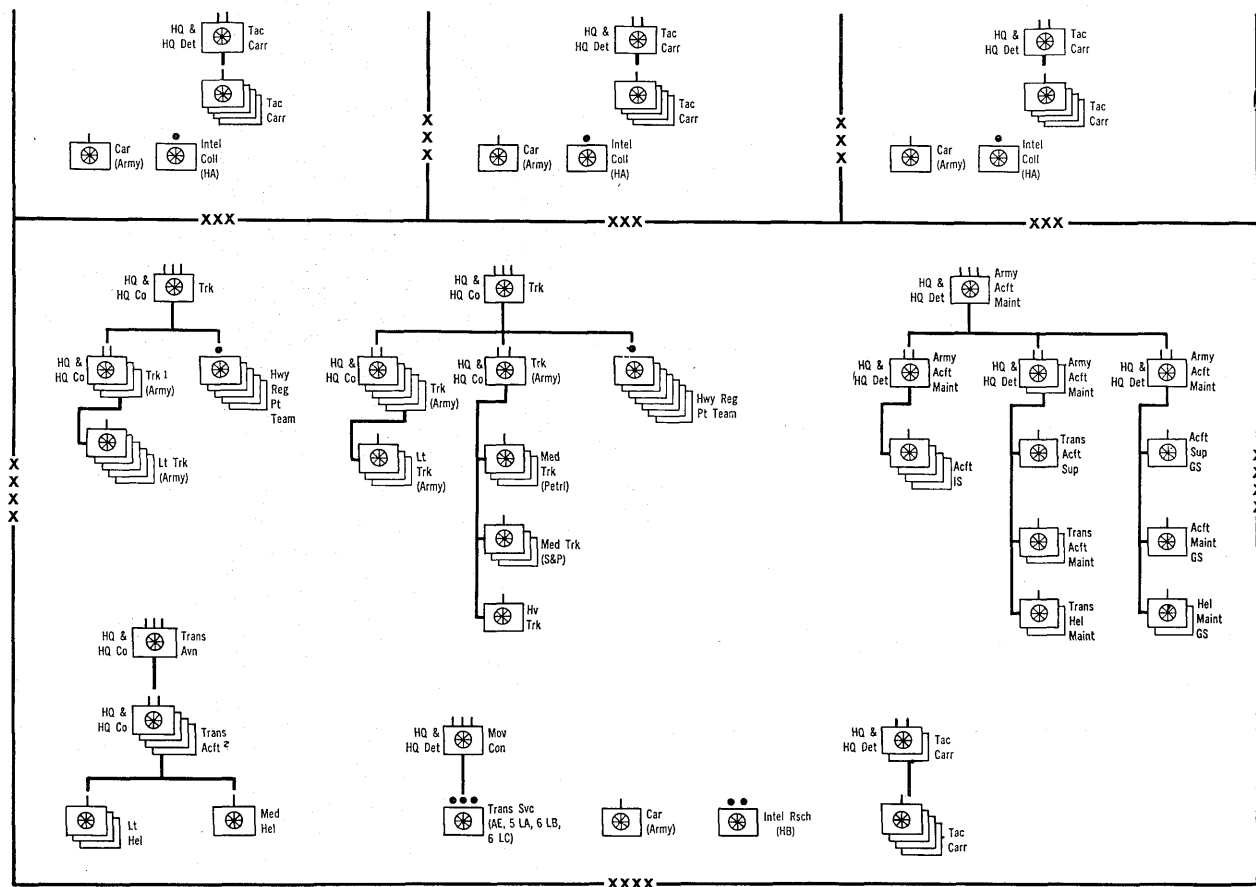
p. Transportation Corps Units.

(1) Numbers and types—Transportation Corps units.

	1	2	3	4	5
	Unit	TOE	Corps	Army	Total army
1					
2	HQ & HQ det, trans acft maint & sup gp-----	55-452		1	1
3	HQ & HQ det, trans army acft maint bn-----	55-456R		4	4
4	Trans acft DS co-----	55-458		4	4
5	Trans trans acft maint co-----	55-468		4	4
6	Trans trans hel maint co-----	55-469		4	4
7	Trans GS acft sup co-----	55-477		1	1
8	Trans GS acft maint co-----	55-478		1	1
9	Trans GS hel maint co-----	55-479		2	2
10	HQ & HQ co, trans trk gp-----	55-12R		2	2
11	HQ & HQ co, trans trk bn (army)-----	55-16R		9	9
12	Trans mov con gp (AE, 5 LA, 6 LB, 6 LC)-----	55-500R		1	1

	1	2	3	4	5
	Unit	TOE	Corps	Army	Total army
1					
13	Trans hwy reg pt-----	55-500R		12	12
14	Trans lt trk co-----	55-17D		30	30
15	Trans med trk co (petrl)-----	55-18D		3	3
16	Trans med trk co (S&P)-----	55-18D		3	3
17	Trans car co (army)-----	55-19C		4	4
18	Trans tech intel det				
	Intel rsch (HB)-----	55-500R		1	1
	Intel coll (HA)-----	55-500R		3	3
19	Trans hv trk co-----	55-28C		1	1
20	HQ & HQ det, trans tactical carr bn-----	55-46D	1	2	5
21	Trans tactical carr bn-----	55-47D	4	8	20
22	HQ & HQ co, trans avn gp-----	55-102D		1	1
23	HQ & HQ co, trans acft bn-----	55-56D		4	4
24	Lt hel co, avn trans bn-----	55-57D		12	12
25	Trans med hel co-----	55-109T		4	4

(2) Schematic diagram — Transportation Corps units.



1 Normally utilized for tactical troop movements.

2 Normally, each battalion has one aviation company, fixed wing, light transport, assigned for operations. (See para d(2).)

q. Miscellaneous—Numbers and Type.

	1	2	3	4	5
	Unit	TOE	Corps	Army	Total army
1					
2	HQ, army-----	51-1C	----	1	1
3	HQ co, army-----	51-2C	----	1	1
4	HQ sp trp, army-----	51-3C	----	1	1
5	HQ, corps-----	52-1C	1	----	3
6	HQ co, corps-----	52-2C	1	----	3
7	HQ & HQ det, repl gp-----	20-52C	----	1	1
8	HQ & HQ det, repl bn-----	20-56C	----	6	6
9	Repl co-----	20-57C	----	24	24
10	MRU type Z (consol aug) (mbl)-----	12-510R	----	1	1
11	MRU type Z (mbl aug)-----	12-510R	----	4	4
12	Army postal reg det-----	12-47D	----	2	2
13	APU type Z-----	12-605C	----	4	4
14	Fin disbursing sec (AC, FL, GA, HB)-----	14-500R	----	15	15
15	Sp svc co-----	12-17R	----	1	1
16	CAMG gp (AC, AG, BB, BI, CC, CG, CK, CM, CU, DB, DE, DG, EC, EF, EI)-----	41-500R	----	1	1
17	CAMG co (AB, AE, CB, CF, CJ, CL, CT, DA, DD, EB, EE)-----	41-500R	1	----	3
18	CAMG plat, div (AA, AD, BR, CA, CE, CL, CS, EA, ED)-----	41-500R	1	4	12
19	Loudspeaker & leaflet co, army-----	33-77R	----	1	1
20	Sep band-----	12-107C	----	1	1

¹One per division.

4.3. Troop Requirements—Communications Zone

a. There is no prescribed organization or *type* composition for a communications zone. The communications zone troop list should be specifically tailored to efficiently perform the minimum essential support functions. Factors which influence the support structure in the communications zone are as follows:

- (1) *Mission.* The mission of the theater determines in a large measure the load which will be placed upon a communications zone.
- (2) *Supported strength.* The total strength to be supported, both combat zone and communications zone personnel, influences both the size and types of support which must be provided. Included in these strength considerations must be the support require-

ments for Air Force, Navy (including Marine), Allied troops, and civil affairs/military government personnel.

- (3) *Troop availability.* The availability of service troops and supporting equipment will influence communications zone organization.
- (4) *Geography, climate, and cultural development.* These factors affect the support levels required for the efficient conduct of military operations. Favorable climate and terrain tend to decrease many service requirements; whereas, cultural developments may increase or decrease requirements, depending upon the nature of military operations conducted.
- (5) *Concept of logistical support.* Just as the mission of the theater determines the load placed upon a communications zone, the logistical support concept employed will determine the efficiency of support services.

b. For data pertaining to the normal assignment, capabilities, and strengths of technical and administrative service units, see Part II, FM 101-10 (when published).

4.4. Troop Requirements—Airborne Operations

a. General.

- (1) The troop requirements for an airborne force are determined by the number of airborne and infantry divisions assigned; the mission; the terrain and weather in the objective area; enemy dispositions and capabilities; availability of aircraft; probable length of time the airborne force must be supported by air lines of communication; the availability of administrative support; and other pertinent factors. The complete dependence of an airborne force on a single communication system—air lines of communication—until surface link-up is established requires that troop requirements be very carefully determined for each airborne operation being planned.
- (2) Normally the troop list for the Army component of an airborne force in-

cludes those units that will be directly employed in the operation in a combat or supporting role. It does not include units required to support the marshalling of the Army forces or the logistical or administrative support that may be furnished by the communications zone agency designated to mount and support the airborne operation.

- (3) The number of airborne divisions and corps allocated to theaters of operation will vary. Such units will be furnished by the Department of the Army based on Joint Chiefs of Staff directives.
- (4) The Army component of an airborne force is usually responsible for its own logistical support in the airborne objective area, regardless of the size or composition of the Army forces. Therefore, the troop list for the Army component of an airborne force will contain sufficient service troops to provide logistical support in the airborne objective area. In all airborne operations, the provision of service support to the Army forces in the objective area by units located in the departure area will be carefully considered and used to the maximum extent permitted by the characteristics of the operation being planned. Usually the nature of the service provided by the units concerned will determine whether they will be assigned to the Army component of the airborne force or to the communications zone agency supporting the operation. Normally the number of Army service troops required in an airborne objective area will be considerably less than the number employed by a ground force containing the same number of divisions.

b. Employment of TOE Units. The same types of combat and service troops shown for the typical field army in paragraph 4.2 will be used to support airborne divisions, infantry divisions, corps, and armies used in airborne operations. The number of supporting units used will be scaled down to provide only the requirements of the specific force being organized. Frequently the strength and organic

equipment of a supporting unit will be reduced to enhance its air transportability. Lighter equipment may be substituted for heavy equipment. Because of the inherent differences between ground and airborne operations, many of the units shown in paragraph 4.2 may be omitted from the airborne troop list, while others may be assigned to the communications zone agency supporting the airborne operation. Of those units assigned to the Army component of the airborne force, a portion may operate within the objective area, while others will support the operation from the departure area.

c. Employment of Special Units. Special units or TOE units with special training and equipment are required for certain airborne operations, particularly those of the independent type.

- (1) Specifically tailored, trained, and equipped engineer units organized primarily around the engineer light equipment company and the engineer combat battalion (army) are required when airfields are to be rehabilitated or air-landing facilities constructed.
- (2) Specially organized, trained, and equipped units are required to provide air terminal facilities in the objective area when large tonnages of supplies and equipment will be delivered by air for a prolonged period. Normally this support will be provided by Air Force units.
- (3) The numbers and types of the special units required will be determined separately for each airborne operation, based on such factors as the airfield repair and construction requirements in the objective area; the tonnage of supplies and equipment to be received in the objective area via air transportation; and the method of supply distribution that will be used in the objective area.

4.5. Troop Requirements—Amphibious Operations

The table below is designed to determine the units required in addition to the units organic and normally attached to regimental combat teams, divisions, and corps to provide a balanced shore party troop list for an am-

phibious assault. Troop assignment (in the table) is based on a corps with three divisions in the assault. The factors used as a basis for determining the troop requirements can only be used to provide an estimate of requirements. Modifications and adjustments must be made to meet the peculiarities of a particular situation.

Typical Shore Party Troop List

	1	2	3	4	5
	Unit	TOE	Per BGLT ^{1 2}	Per inf div ^{1 2}	Per corps ^{1 2}
2	Comd HQ, engineer amphibious support command (EASC) ³	5-501			1
3	Engineer units:				
3	Engr cmbt bn (army) ³	5-35		1	5
4	Engr co	5-37	1		
5	Engr fld maint co	5-157			1
6	Det, engr fld maint co			1	
7	Svc spt bn, EASC ^{3 4}	5-505			1
8	Det, CDS co, svc spt bn			1	
9	Det, comm co, svc spt bn			1	
10	Engr amph bn, EASC ^{3 4}	5-525			1
11	Engr amph spt co	5-527		1	
12	Engr amph eqp bn, EASC ^{3 4}	5-535			1
13	Engr amph eqp co	5-537	1	2	5
14	Engr lt eqp co	5-367			1
15	Engr sup pt co	5-48			1
16	Chemical units:				
16	Cml smk genr bn	3-266		1	3
17	Smk genr co	3-267	1		6
18	Cml co, smbt spt	3-7			1
19	Medical units:				
19	Med co, svc spt bn, EASC ^{3 4}	8-60			1
20	Spt plat, med co, svc spt bn			1	
21	Med svc bn	8-26			1
22	Med evac co (amb)	8-17 ATFA		1	3
23	Clr co	8-28		1	3
24	Clr plat		1		
25	Med coll co	8-27		1	3
26	Plat, med coll co		1		
27	Fld hosp	8-510 ATFA			3
28	Air amb co	8-29			1

	1	2	3	4	5
	Unit	TOE	Per BGLT ^{1 2}	Per inf div ^{1 2}	Per corps ^{1 2}
29	Ordnance units:				
29	Ord bn (maint and sup)	9-76			1
30	Ord DS autmv spt co	9-127			1
31	A u t m v plat			1	
32	Ord fld sup co ⁵	9-57			3
33	EOD det	9-510		1	3
34	Ord ammo co ⁵	9-17 (Tent)			2
35	Signal units:				
35	Sig co, svc spt bn, EASC	11-608D			1
36	Det, sig supt maint bn	11-155D			1
37	Sig co (sep)	11-500			1
38	Plat, sig co (sep)			1	3
39	Quartermaster units:				
39	QM svc co	10-67		2	8
40	Plat, QM svc co		1		
41	QM bn	10-536		1	4
42	QM subs sup co	10-197			1
43	Subs sup plat			1	
44	QM petrl sup co (mbl)	10-77		1	3
45	QM salv co	10-187			1
46	Salv plat			1	
47	QM recov and dspo co	10-297			1
48	Recov and dspo plat			1	
49	Transportation units:				
49	Trans boat bn	55-126		1	4
50	Trans lt boat co	55-127		1	3
51	Trans med boat co	55-128	1	2	6
52	Trans hv boat co ⁵	55-129			1
53	Trans floating craft dep maint co	55-157			1
54	Trans harbor craft unit ⁵	55-500			1
55	Trans trk bn	55-16		1	3
56	Trans lt trk co	55-17		1	3
57	Trans term bn	55-116			3
58	Trans term svc co	55-117		1	6
59	Trans amph trk co	55-137	1	2	6

	1	2	3	4	5
	Unit	TOE	Per BGLT ^{1,2}	Per inf div ^{1,2}	Per corps ^{1,2}
60	Trans acft DS co...	55-458			1
	Military police units:				
61	MP bn.....	19-35			1
62	MP co.....	19-37		1	3
63	Plat, MP co.....		1		
64	MP esc gd co.....	19-47		1	3
65	Plat, MP esc gd co.....		1		
	Navy unit:				
66	Naval beach group ⁶	USN		1	3
67	Aslt det, naval beach group.....		1		
	Air Force units:			(7)	(7)

¹ TOE units shown under columns 4 and 5 can be broken down and assigned to support subordinate commands as the situation may require.

² Figures in column 4 include those in column 3; figures in column 5 include those in column 4.

³ Units organic or permanently attached to EASC. Remaining units are normal attachments to the EASC when acting as the shore party for a corps.

⁴ Detachments may be attached to a division when EASC headquarters is not employed.

⁵ Units usually attached to divisions.

⁶ Less boat unit if US Army boats are employed.

⁷ Air Force service elements to support Air Force units with the landing force.

4.6. Troop Planning Slices

a. Purpose. In logistical planning, a preliminary estimate of the total size of a force is required to determine the final composition and the ultimate size of the force, since the required number of many service units, such as hospitals, depot units, etc., bears a direct relationship to the size of the total force. Two factors are used in such planning, the *division slice* and the *wing slice*. To determine the preliminary total of the force, multiply the division slice by the number of divisions in the force and add the product thus obtained to that of the wing slice multiplied by the number of wings in the force; to the sum thus obtained must be added the various miscellaneous forces not included in either slice.

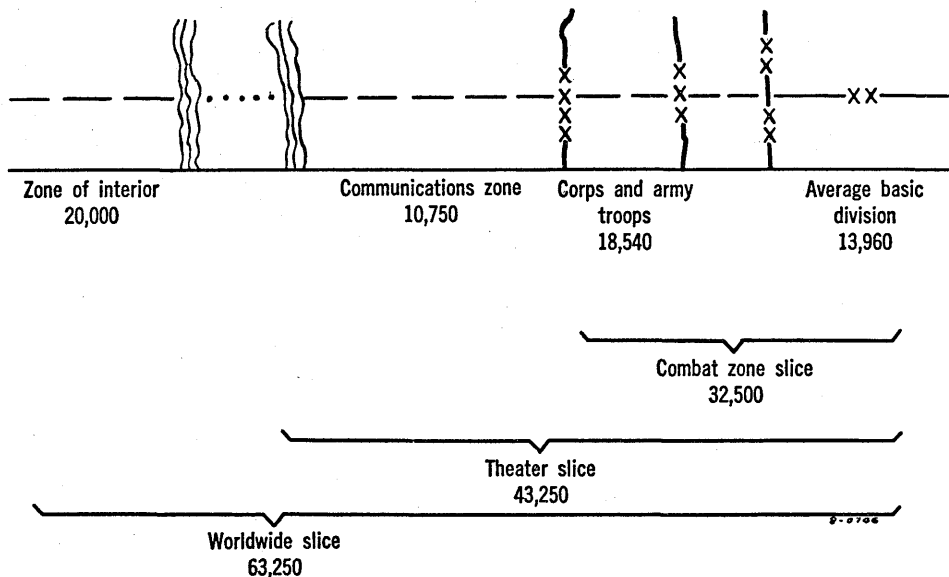
b. Definitions.

- (1) The *division slice* includes the strength of an average combat division plus proportionate shares of the total corps, army, communications zone, and zone of interior (for worldwide slice only) units operating to the rear of the division (and of Naval units directly supporting the Marines in case of Marine divisions). The division slice for any given force is equal to the total strength of the force divided by the number of combat divisions in the force.
- (2) The *wing slice* includes the strength of an average wing plus a proportionate share of the Air Force and Army units engaged in developing or operating the airbases (and of Naval units which directly support the Marine or Naval air units).

c. Relation Between Division Slice and Wing Slice. The 7,000-man wing slice includes about 1,000 Army communications zone men not counted in a division slice. These 1,000 Army men are required for communications zone support of Air Force units and installations present in the theater of operations. In the charts in *d* below, and in *a* and *b* above, this same assumption is made—the wing slice and not the division slice contains the communications zone support for Air Force. This allows troop planners to use these tables with varying ratios of air wings to Army divisions in any specific force.

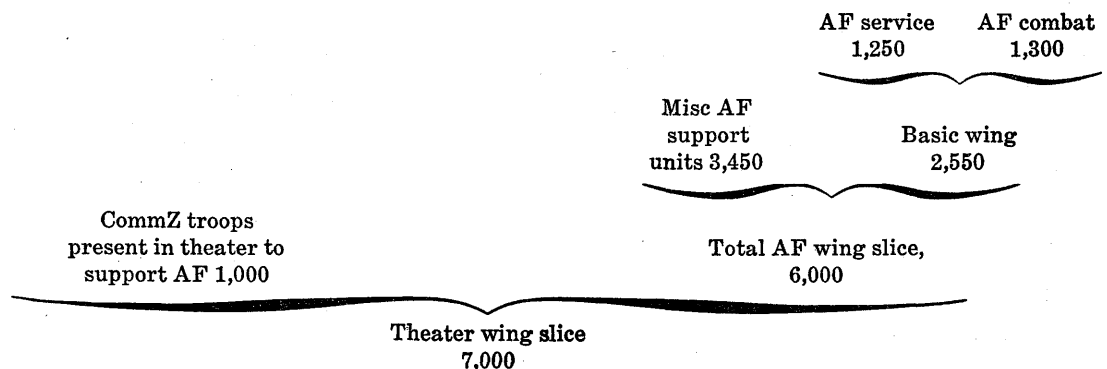
d. Basic Slice Factors. (See pars. 5.47 and 9.2 for location of slice components as contrasted with assignment of slice components shown here.)

- (1) *Division slice* (U.S. Army troops only).



- (2) *Wing slice* (U.S. Air Force combat service and support troops and U.S. Army troops present, because Army

supports Air Force in certain functions):



- (3) *Amphibious assault and buildup.* Initially in an amphibious assault, all elements are smaller than shown in (1) and (2) above and reach the strength shown there gradually during buildup. Division slices varying from 22,000 to 30,000 men have proved satisfactory in the long-range planning estimation of strengths for an amphibious assault including followup. The value of 25,000 is recommended for general planning purposes. The number of vehicles to be landed with assault troops is estimated on the basis of 1 vehicle per 10 men for long voyages, 1 vehicle per 7 men for short voyages (due to differences in types of shipping). Division slices varying from

35,000 to 40,000 men have proved satisfactory in the estimation of peak strengths, achieved between D+30 and D+90, in an amphibious operation. The value of 40,000 men is recommended for general planning purposes. The number of vehicles to be landed in buildup for a force is estimated on the basis of providing enough to increase the ratio of vehicles per man to 1 vehicle to 5 or 6 men of the total (assault and buildup) force.

4.7. Division and Wing Slices

a. Division Slice. The following table presents the percentages of each arm, service, and other major grouping in each part of a large balanced force. It is based on troop deployment

at the end of World War II. This troop deployment contained 89 divisions—5 airborne, 16 armored, 1 cavalry, 66 infantry, and 1 mountain. This table has been modified to conform to the current type field army, current divisions and the consolidation of all artillery in one arm, the consolidation of cavalry, armored, and tank destroyer units into one armor branch, the

transfer of certain truck and car units from Quartermaster Corps to Transportation Corps, and the separation of the Air Force from the Army. The communications zone column does *not* include those Army communications zone troops who must be present to support the Air Force (par. 4.6*b* and *c*).

Division Slice

Branch or other major groupings	Worldwide slice		Theater slice		Combat zone slice		Average division only (13,960 men)
	Total (63,250 men)	ZI portion (20,000 men)	(Army)		(Army)		
			Total (43,250 men)	CommZ portion (10,750 men) ¹	Total (32,500 men) ²	Corps Army and rear portion (18,540 men) ²	
Combat division.....	22.1	0	32.3	0	42.9	0	100
HQ units, AG, FD, sp svc, and other administrative and intelligence services including operating overheads (including for ZI defense command overheads and DA agencies).....	5.5	9.5	3.7	8.4	2.6	4.6	0
Armor.....	2.5	.3	3.5	.1	6.1	10.9	0
Artillery.....	7.7	1.6	10.6	.1	17.1	30.9	0
Aviation.....					1.1	2.0	
Chemical.....	.5	.2	.6	.7	.6	1.0	0
Engineer.....	7.7	4.0	9.0	12.0	8.6	15.0	0
Infantry.....	1.5	.4	2.3	.2	1.7	2.9	0
Medical.....	5.9	4.9	6.5	16.0	3.9	6.8	0
Military police.....	1.1	.9	1.2	2.0	1.1	1.9	0
Ordnance.....	4.0	1.8	5.0	6.9	5.2	9.1	0
Quartermaster.....	4.7	2.6	5.6	14.7	2.8	4.9	0
Signal.....	2.8	1.7	3.3	7.0	3.0	5.2	0
Transportation.....	5.6	5.0	6.0	16.2	2.8	4.8	0
Replacements.....	10.0	23.0	3.7	¹ 15.7	³ (2.3)	³ (4.9)	0
Bulk pers ZI only.....	8.8	27.9	0	0	0	0	0
Misc ZI only.....	5.1	16.2	0	0	0	0	0
Total percentage.....	100	100	100	100	100	100	100
Percentage of worldwide slice.....	100	31.6	68.4	17.0	51.4	29.3	22.1
Percentage of theater slice.....			100	24.8	75.2	42.8	32.3
Percentage of combat zone slice.....					100	56.9	42.9

¹Includes replacements in field army areas.

²Does not include replacements.

³Not included in field army percentage total.

b. Wing Slice. This table presents the percentages of components, branch, and other major groupings present in the theater of oper-

ations. It is based upon a hypothetical USAF troop list and a hypothetical Army force.

Theater Wing Slice

	1	2	3	4
1	Component, branch, or other major grouping	Theater total 7,000 men	Air Force total 6,000 men	Basic wing 2,550 men (1,300 combat) (1,250 service) ¹
	Air Force:			
2	HQ and overhead ²	(3.0)	(3.3)	
3	Combat.....	18.6	21.7	51.0
4	Service.....	17.9	20.8	49.0
5	Misc support.....	49.2	57.5	
	Army:			
6	CommZ support.....	14.3		
7	Total percentage.....	100.0	100.0	100.0
8	Percentage of wing slice.....	100.0	85.7	36.4

¹ Located on the combat airfield, includes all elements organic to wing.

² Includes various Air Force headquarters and miscellaneous overhead units. Percentages in parentheses are included within total percentages of miscellaneous support, line 5.

Army Support by Service

	HQ & misc overhead	Cml	Engr	Med	Ord	QM	Sig	Trans	Total
Percentage of 1,000 men.....	10.0	.9	11.2	4.4	2.6	5.4	7.0	3.5	100

Section II. TACTICAL TROOP MOVEMENTS

4.8. General

a. Introduction. The examples of forms for movement tables and graphs are included as guides for the preparation of similar tables for units in the field. Tables for field use must conform to the variations of strength of units and the amount of transportation and equipment available. Battle groups, separate battalions, and similar units should maintain tables showing road space requirements of their units based on actual strength and materiel on hand. Reports of subordinate units form the basis for tables of larger units. However, a table based on actual strength of men and materiel may be worthless without proper evaluation of the weather, road conditions, hostile air and mechanized threats, or other variable factors affecting the troop movement. These basic figures are capable of great increase or decrease under extremes of the variable factors. Troop movement data as given in the examples of tables of basic road spaces and tables of rates and lengths of marches are average from field experience.

b. Basic Road Spaces. The following values apply in computing road spaces, except when greater dispersion is desired to reduce the effect

of unfavorable factors such as those mentioned in *a* above:

(1) Foot troops (at halt or marching):¹

	2 yd per man	5 yd per man
Single file, per man.....	2.4	5.4
Column of twos, per man.....	1.2	2.7

(2) Motor elements (at halt):²

Road space (yards)³

Car passenger	8
Half-track or armored carrier	8
Tank	8
Tank with cargo carrier or weapon in tow	11
Tractor	7
Tractor, with cargo trailer or weapon in tow	15
Tractor, 5-ton with semitrailer 10- ton, 25; S & P	14
Trucks:	
1/4-ton	5

¹ For time length of foot elements in column, see *c* below. Factors do not include normal distances between units.

² For road spaces and time lengths for motor elements at various rates of march, see paragraph 4.10d.

³ Allows 1 to 2 yards between vehicles. See chapter 5 for actual lengths of vehicles, towed weapons, and trailers.

Trucks—Continued

1/4-ton with cargo trailer or weapon in tow	8
1/2- or 3/4-ton	6
1/2- or 3/4-ton with cargo trailer or weapon in tow	10
2 1/2-ton	9
2 1/2-ton with cargo trailer or weapon in tow	16
Over 2 1/2-ton	9
Over 2 1/2-ton with cargo trailer in tow	13
6-ton cargo (treadway)	14
Average per vehicle for a mixed column of various types	10

(3) Use of values.

- (a) A battle group of 1,000 men organized as 5 companies, totaling 21 platoons; company distances—100 yards; platoon distances — 50

yards; formation—column of twos,
5 yards between men:

$$\begin{aligned}\text{Road space} &= 1,000 \times 2.7 + 4 \times \\ &\quad 100 + 16 \times 50 \\ &= 2,700 + 400 + 800 \\ &= 3,900 \text{ yards}\end{aligned}$$

- (b) A mixed motor column consisting of—

	Yards
20 trucks, 1/4-ton, with weapons in tow at 8 yards each	160
25 trucks, 3/4-ton, with trailer in tow at 10 yards each	250
40 trucks, 2 1/2-ton, with trailers in tow at 16 yards each	640
40 tanks at 8 yards each	320

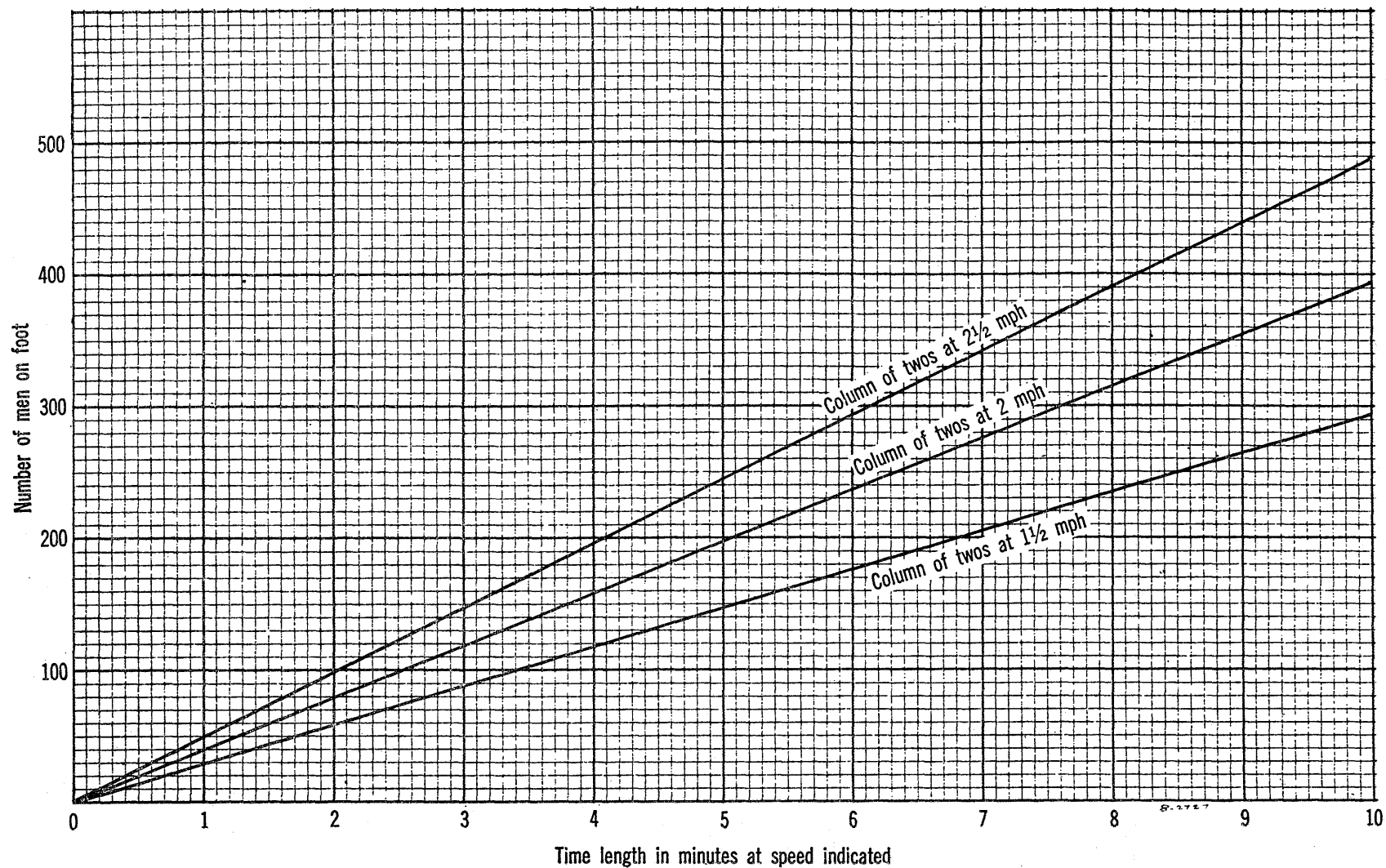
125 total

Total road space at halt1,370

Alternate solution (see (2) above):

125 vehicles (mixed) at 10
yards each1,250

c. Average Time Lengths of Columns on Foot. (Does not include unit intervals.)



*d. Rates and Lengths of Road Movements,
Foot, and Motor Elements.**

(1) The following rates and lengths of

marches are based upon modern vehicles, trained personnel, and favorable conditions of roads and weather:

	1	2	3	4	5	6	7
1	Unit	Rates of march (MPH) ¹				Lengths of march on roads (miles per day average) ²	Remarks
		On roads ²		Cross country			
		Day	Night	Day	Night		

INFANTRY⁴

2	Foot troops-----	2½	2-----	1½	1-----	12-15 for a division, 15-20 for smaller units.	Length of march increased with well-seasoned troops marching on good roads in favorable weather when required by the tactical situations. ³
---	------------------	----	--------	----	--------	--	--

ARTILLERY

3	Truck-drawn, light or medium	25	25 (lights)----- 10 (no lights).	8	5	175	
4	Tractor-drawn, medium (M5)	21	15 (lights)----- 10 (no lights).	10	4 (lights)----- (1½ no lights).	150	
5	Truck-drawn, heavy-----	18	18 (lights)----- 10 (no lights).	6	4	135	
6	Tractor-drawn, heavy-----	15	15 (lights)----- 10 (no lights).	6	4 (lights)----- (1½ no lights).	135	
7	Antiaircraft artillery, truck-drawn.	20	20 (lights)----- 10 (no lights).	8	5	175	
8	Antiaircraft artillery, self-propelled.	20	20 (lights)----- 10 (no lights).	12	5	175	

ARMORED

9	Tanks, light, and armored carriers.	20	20 (lights)----- 10 (no lights).	12	5	150	Armored division moves at rate of march of medium tanks.
10	Tanks, med-heavy-----	15	15 (lights)----- 10 (no lights).	5	3	100	

MISCELLANEOUS

11	Infantry division, motorized.	15	15 (lights)----- 10 (no lights).			150	Single vehicles or small columns of less than 50 vehicles.
12	Trucks and ambulances not carrying patients.	25	25 (lights)----- 10 (no lights).			150	
13	Ambulances carrying patients.	15	10 (lights)-----	5	5	135	
14	Cars, passenger.	35	35 (lights)----- 10 (no lights).			250	

* The rate of march of a column of elements with different rates of march is regulated by that of the slowest element.

¹ Rate of march is average speed over a period of time, including short, periodic halts.

² Rates of march for motorized elements listed in columns 2 and 3 are possible only on improved roads.

³ Greater distances than those given in column 6 may be covered under forced march conditions.

⁴ For movement over mountainous terrain, an additional allowance of 1 hour should be made for each 1,000 feet of climb.

(2) *Road movements in snow and extreme cold.*

- (a) *Foot.* Foot troops marching in snow without snowshoes or skis will have their mobility decreased. The decrease of mobility will depend on several factors, among which are depth and nature of the snow. Normally, snow of a depth of 24 inches or more will prohibit marching unless skis or snowshoes are used. For specially equipped and adequately trained troops, the following rates of march are practicable:

Snowshoes ...1½ to 2½ miles per hour.

Skis1½ to 3½ miles per hour.

Small bodies of well-trained troops are capable of moving 40 miles a day on skis, under favorable conditions.

- (b) *Motor movement (wheel) in snow.*

Depth snow (in.)	Measures required for movement
3-----	None.
6-----	Rear chains.
6-18-----	Chains all around; and special traction devices on leading vehicles (to break the trail).
18 and over	Snowplow required.

e. *Forced Marches of Foot Elements.* For planning purposes, a normal foot march covers 20 miles per day at a rate of 2½ miles per hour. A forced march requires the expenditure of more than the normal effort in speed, exertion,

hours marched, or a combination of these. Although forced marches impair the fighting efficiency of a unit, urgent conditions on the battlefield may require a maximum effort. Full advantage should be taken of those periods when the troops are most rested to increase the rate of march. Rest periods should be scheduled to avoid marching at extremely hot times of the day and to insure the arrival of the unit in effective condition to fight.

f. *Vehicle Capacities for Personnel.* The capacity of motor transportation for movement of foot troops depends upon the rated capacity of the transportation employed, the type of body on the vehicles, the method of carrying personnel, and the distance personnel are to be moved. Normal capacities for trucks carrying personnel with hand-carried weapons, packs, and extra ammunition, with no additional cargo, are—

	Men
Armored carrier (excluding driver)-----	11
Truck, ¼-ton (excluding driver)-----	3
Truck, ¾-ton (excluding driver)-----	9
Truck, 2½-ton (excluding driver)-----	20
Semitrailer, 12-ton (excluding driver)-----	50

Note. When 2½-ton engineer dump trucks or 2½-ton short-wheelbase artillery trucks carry the loads shown above, some personnel will be required to stand.

g. *Tabulating Number of Trucks Required for Movement by Motor Transport.* The following format may be used to tabulate the approximate number of trucks required to move foot elements with individual equipment.

	1	2	3	4	5
1	Unit	Actual strength	Transported in organic motors	Strengths for which transportation must be furnished	Number of $2\frac{1}{4}$ -ton trucks required
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					
14					

4.9. Basic Terms and Formulas

a. *Traffic Flow of Motor Columns.* Traffic flow is defined as the total number of vehicles passing a given point in a given time. Traffic flow is expressed in vehicles per hour and can be determined for any route by this formula—

Traffic flow in vehicles per hour = Density in vehicles per mile $\times$ speed in miles per hour $\times F$.

F (a variable) depends upon the standing operating procedure time intervals between march units and serials applicable in the area and upon the overall state of proficiency of units operating in the area in motor movement and traffic control. For adaptation to a specific area under field conditions, it is necessary that time and space studies be conducted continuously in order to arrive at a suitable factor. This study may result in a basic factor to which allowance for time interval between march units and serials must be added, or a basic factor including allowance for time interval between march units and serials.

b. *Density of Motor Columns.*

- (1) Density is defined as the number of vehicles per mile of road space occu-

pied by vehicles. Motor columns may be classified as either close column, open column, or infiltration.

- (a) *Close column.* In close column, vehicles are closed to safe driving distance behind the preceding vehicle. Usually a fixed speedometer multiplier (SM)* is specified (such as 2, 2.35, 2.5, 3, etc.) to accomplish a safe-driving intervehicular distance at all speeds.
- (b) *Open column.* In open column, distances between vehicles are increased to accomplish greater dispersion. Usually a fixed distance (such as 100 or 200 yards between vehicles) is specified, but open column conditions may be obtained by designating a fixed speedometer multiplier high enough to insure the desired intervehicular lead at the lowest speed expected.

* For logistical purposes, speedometer multiplier (SM) is any number by which speed in miles per hour is multiplied to determine intervehicular lead in yards. *Example:* with an SM of 2, the intervehicular lead of 2 successive vehicles (measured between vehicles) at a speed of 10 MPH is $2 \times 10 = 20$ yards; at a speed of 25 MPH, it is $2 \times 25 = 50$ yards.

(c) *Infiltration.* In infiltration, vehicles are dispatched at irregular intervals with a fixed density (such as 3, 4, 5, or 6 vehicles per mile).

- (2) To determine the density of a motor column, when the speed and speedometer multiplier are known, use the following formula:

$$\text{Density} = \frac{1,760 \text{ (yards per mile)}}{\text{Speed (MPH)} \times \text{SM}}$$

For example: with a speed of 20 MPH and a SM of 2, vehicle density equals—

$$\frac{1,760}{20 \times 2} = 44 \text{ vehicles per mile.}$$

c. *Road Space (RS).*

- (1) Road space is defined as the length, expressed in units, of a column on the road. Road space is the sum of the lengths of the vehicles, the distance between vehicles, and the distance between march elements.

- (2) The road space occupied by a motor column may be obtained when the number of motor vehicles in the column (disregarding trailers and towed weapons), the average density (number of vehicles per mile), and the total of the time intervals between subordinate units are known.

$$\text{Road space (miles)} = \frac{\text{Number of motor vehicles}}{\text{Density (vehicles per mile)}} + \frac{\text{time intervals (min)} \times \text{speed (MPH)}}{60}$$

An approximation of road space may be determined by the following:

$$\begin{aligned} \text{Road space (miles)} &= \text{No. of vehicles} \div 75 \text{ (less than 25 vehicles in close column).} \\ &= \text{No. of vehicles} \div 30 \text{ (25 or more vehicles in close column).} \\ &= \text{No. of vehicles} \div 20 \text{ (less than 25 vehicles in open column).} \end{aligned}$$

$$= \text{No. of vehicles} \div 15 \text{ (25 or more vehicles in open column).}$$

$$= \text{No. of vehicles} \div 3 \text{ (any number of vehicles marching by infiltration).}$$

In close column a 15-minute time interval occupies 2.5 miles of road space and in open column 3.75 miles of road space.

d. *Time Length.* The time length of a column is the time required for the column to pass a given point. The time length may be determined by the following formula:

$$\text{Time length (min)} = \frac{\text{Road space (miles)} \times 60}{\text{Speed (MPH)}}$$

An approximation of time length may be determined by the following:

$$\text{Time length (min)} = \text{No. of vehicles} \times 0.08 \text{ (less than 25 vehicles in close column).}$$

$$= \text{No. of vehicles} \times 0.18 \text{ (25 or more vehicles in close column).}$$

$$= \text{No. of vehicles} \times 0.20 \text{ (less than 25 vehicles in open column).}$$

$$= \text{No. of vehicles} \times 0.30 \text{ (25 or more vehicles in open column).}$$

$$= \text{No. of vehicles} \times 1.33 \text{ any number of vehicles marching by infiltration.}$$

e. *Time Distance (TD).* Time distance is defined as the time required for any one individual or vehicle to travel between two given points. Time distance may be determined by the following formula:

$$\text{Time distance (TD)} = \frac{\text{Distance (D)}}{\text{Rate of march (R)}}$$

f. *Road and Time Interval (RI and TI).*

- (1) Road interval is defined as the distance between march elements. The road

interval between march elements is more significant when the column is moving than when the column is halted; therefore, it is generally prescribed as a factor of time rather than distance. (See (2) below.) Road interval may be determined by the following formula:

$$\text{Road interval (RI)} = \frac{\text{Time interval (minutes)} \times \text{rate (MPH)}}{60}$$

- (2) Time interval may be considered as the conversion of road interval to time. There are no prescribed standard time intervals. These will depend on the size of serials and march units, the time available for the movement, as well as the tactics required for protection against air and atomic attack. The infantry division when moving by motor in a tactical march normally moves in 7 serials—1 serial for each battle group task force, 1 serial for division troops, and 1 serial for division trains. The armored division, on the other hand, normally moves in 5 major march serials—1 serial for each combat command, 1 serial for division troops, and 1 serial for division trains. Another major difference between the armored and infantry divisions is the normal organization of the divisional march serials. A combat command is organized into march serials of battalion size and march units of company or battery size; whereas, a battle group task force is organized only into march units of company or battery size. Examples of time intervals are as follows:

Between serials (battle groups or combat commands)—15 minutes.

Between serials (battalion size)—5 minutes.

$$\text{Between march units} = \frac{\text{vehicles}}{25} \times 2.5 \text{ minutes.}$$

4.10. Aids to Planning

a. The detailed work of planning troop movements can be simplified by preparing in advance tables, graphs, and other aids, based upon statistical data and experience factors of the unit. The most important of these aids are—

- (1) Tables of simplified formulas for road space and time length.
- (2) Tables of precalculated road space and time length.
- (3) Road space and time length nomographs.
- (4) Unit table of road space and time lengths.
- (5) Tables of time distances.
- (6) Tables of average time factors.
- (7) Road movement graphs.
- (8) Road movement tables.
- (9) Strip map.
- (10) Vehicle availability tables.
- (11) Vehicle assignment tables.
- (12) March calculators.

b. *An Example of Tables of Simplified Formulas for Road Spaces and Time Lengths.* This table is based on the infantry division (ROCID). A time interval of 2½ minutes between company march units (2½ minutes per 25 vehicles) has been allowed for and built into the formulas. Time interval between serials has *not* been included. Similar tables for other units can easily be constructed, keeping in mind the number of time intervals to be built into the formula.

Column formation	Rate (MPH)	Density (veh/mi)	Number of serials	No. of vehicles in serial	Roads pace (mi)	Time length (min)
Close column	10	75	One ³	25 or less	1.25V ²	0.08V
				More than 25	0.03V	0.18V
			Two or more	25 or less	1.25V + 2.5I ²	0.08V + 15I
				More than 25	0.03V + 2.5I	0.18V + 15I
Open column	15	20	One ³	25 or less	0.05V	0.2V
				More than 25	0.075V	0.30V
			Two or more	25 or less	0.05V + 3.75I	0.2V + 15I
				More than 25	0.075V + 3.75I	0.30V + 15I
Infiltration	15	3	Not applicable	Any number	0.33V	1.33V

¹ Number of vehicles.

² Number of intervals between serials of battle group size.

³ Formulas for one serial are applicable to armored division.

DERIVATION OF SIMPLIFIED FORMULAS

1. Seventy-five vehicles per mile is the density employed when marching in *close column* formation; therefore, each vehicle in a continuous march element occupies a road space of 0.0133 mile. The company march unit (averaging 25 vehicles or less) is assumed to be the continuous march element. This vehicular road space, when multiplied by the total number of vehicles (25 or less) in the column, gives the value for the road space of the column.

$$RS = 0.0133 V \text{ or } \frac{V}{75} \text{ mi}$$

The road space for 1 vehicle can be converted to time length, using the equation, $TL = RS/R$, as follows:

$$TL = \frac{0.0133}{10} \times 60 \text{ (to convert to min)} = 0.08 \text{ min}$$

The constant, 0.08, when multiplied by the total number of vehicles (25 or less) in the column, computes the time length of the column.

$$TL = 0.08 V \text{ min}$$

2. If a *close column* serial consists of more than 25 vehicles, the time intervals between subordinate march units must be considered in the calculations. This is done by converting this time interval, 2½ minutes per 25 vehicles, to 0.10 minute per vehicle and adding this value to the constant, 0.08.

$$TL = 0.18V \text{ min}$$

This value of TL can be converted into road space as follows:

$$TL = \frac{RS}{R}$$

$$RS = TL \times R$$

$$RS = 0.18V \times \frac{10}{60} = 0.03V \text{ mi}$$

Also, road space can be calculated using the following method:

$$RS = \left(\frac{V}{75} \right) + \left(\frac{V}{25} \times \frac{2.5}{60} \times 10 \right) = 0.03V \text{ mi}$$

3. Twenty vehicles per mile is the density employed when marching in *open column* formation; therefore, each vehicle occupies a space of 0.05 mile. For a continuous element, then:

$$RS = 0.05V \text{ or } \frac{V}{20} \text{ mi}$$

The road space for 1 vehicle can be converted to TL as follows:

$$TL = \frac{0.05}{15} \times 60 \text{ (to convert to min)} = 0.2 \text{ min}$$

The constant, 0.2, when multiplied by the total number of vehicles (25 or less), computes the TL of the column.

$$TL = 0.2V \text{ min}$$

4. If an *open column* serial consists of more than 25 vehicles, the TI between subordinate march units, 0.10 minute per vehicle, must again be considered. Thus—

$$TL = 0.3V \text{ min}$$

This value of TL can be converted as in paragraph 2 above.

5. Whenever a column (*open* or *close*) consists of 2 or more march serials of battle group size, the 15-minute time interval between these serials must be considered in calculations.

Example—

$$\begin{aligned} & \text{(Veh + intervals between subordinate units)} & \text{(Intervals between serials)} \\ & \text{(Close column)} & \\ & \text{TL} = 0.18V & + & 15I \text{ min} \\ & \text{(Close column)} & \\ & \text{RS} = 0.18V \times \frac{10}{60} + \left(\frac{15 \times I \times 10}{60} \right) = 0.03V + 2.5I \end{aligned}$$

6. Three vehicles per mile is the density em-

ployed when marching by *infiltration*; therefore, each vehicle occupies a road space of 0.33 mile. This road space, when multiplied by the total number of vehicles, gives the road space of the column.

$$\text{RS} = 0.33 V \text{ or } \frac{V}{3} \text{ mi}$$

This road space can be converted to TL as follows:

$$\text{TL} = \frac{V}{3} \times \frac{60}{15} = \frac{4V}{3} \text{ min}$$

c. An Example of a Table of Precalculated Road Spaces and Time Lengths. (This example is based on simplified formulas, *b* above.)

Part I—Movement of less than 25 vehicles

Number of vehicles in the column	Roads space (miles)		Time length (minutes)	
	Close column 75 veh/mi—10 mph	Open column 20 veh/mi—15 mph	Close column 75 veh/mi—10 mph	Open column 20 veh/mi—15 mph
1	0.013	0.05	0.08	0.20
2	0.026	0.10	0.16	0.40
3	0.039	0.15	0.24	0.60
4	0.052	0.20	0.32	0.80
5	0.065	0.25	0.40	1.00
6	0.078	0.30	0.48	1.20
7	0.091	0.35	0.56	1.40
8	0.104	0.40	0.64	1.60
9	0.117	0.45	0.72	1.80
10	0.130	0.50	0.80	2.00
20	0.260	1.00	1.60	4.00

Part II—Movement of 25 or more vehicles

Number of vehicles in the column	Road space (miles)		Time length (minutes)	
	Close column 75 veh/mi—10 mph	Open column 20 veh/mi—15 mph	Close column 75 veh/mi—10 mph	Open column 20 veh/mi—15 mph
1	0.03	0.075	0.18	0.3
2	0.06	0.150	0.36	0.6
3	0.09	0.225	0.54	0.9
4	0.12	0.300	0.72	1.2
5	0.15	0.375	0.90	1.5
6	0.18	0.450	1.08	1.8
7	0.21	0.525	1.26	2.1
8	0.24	0.600	1.44	2.4
9	0.27	0.675	1.62	2.7
10	0.30	0.750	1.80	3.0
20	0.60	1.500	3.60	3.3
30	0.900	2.25	5.40	9.00
40	1.200	3.00	7.20	12.00
50	1.500	3.75	9.00	15.00
60	1.800	4.50	10.80	18.00
70	2.100	5.25	12.60	21.00
80	2.400	6.00	14.40	24.00
90	2.700	6.75	16.20	27.00
100	3.000	7.50	18.00	30.00
200	6.000	15.00	36.00	60.00
300	9.000	22.50	54.00	90.00
400	12.000	30.00	72.00	120.00
500	15.000	37.50	90.00	150.00

Illustrations of use.

PROBLEM. Determine the time length of 2 infantry battle groups, each motorized (175 vehicles each) and moving in the same serial in close column formation.

ANSWER. Add the following values from the above table:

TL for 300 vehicles = 54.00 minutes

TL for 50 vehicles = 9.00 minutes

TI = 15.00 minutes (Time interval between serials of battle group assumed to be 15 minutes for purposes of this example.)

TL = 78.00 minutes for 350 vehicles.

Note. 2½-minute time intervals between company march units have been allotted for and built into the values in the table.

d. Road Space and Time Length Nomograph.

(1) The following nomograph shows average road spaces and time lengths under ideal conditions and does *not* include allowance for time intervals between march units. Actual road space and time length may vary somewhat depending upon conditions.

(2) To determine road space—

(a) Determine the number of motor vehicles in column, disregarding trailers or towed weapons.

(b) Locate the figure on vertical scale at

left of chart, marked “number of vehicles.”

(c) Locate the figure showing average density under which the movement will be made on the vertical scale marked “Density, veh/mi.”

(d) Connect these two points with a straightedge. Read the figure at the point of intersection of the straightedge with the vertical scale marked “Road space, miles.”

(e) This will be the road space, in miles, occupied by the column under the given conditions.

(3) To determine time lengths—

(a) Obtain road space as directed in (2) above.

(b) Locate the figure representing the speed in miles per hour on the vertical scale marked “Speed, mi/hr.”

(c) Connect these two points with a straightedge.

(d) Read the figure at the intersection of the straightedge with the vertical scale marked “Time length.”

(e) This figure is the time length of the column under the conditions given.

Number
of
vehicles

Road
space

Speed

Density

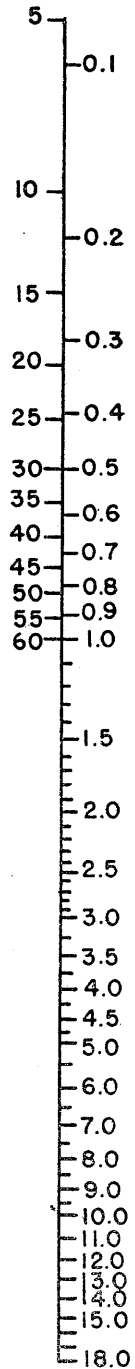
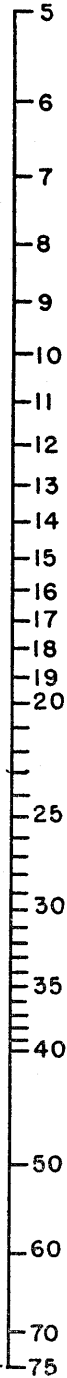
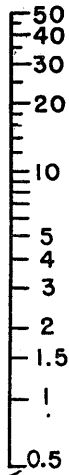
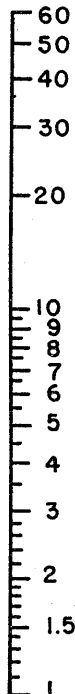
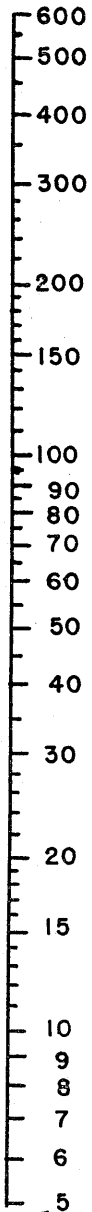
Time
length

(miles)

(mph)

(vehicles
per mile)

Minutes Hours



Step two

*Connect with straight-
edge: read time length*

Step one

*Connect with straightedge:
read road space.*

e. *An Example of Format for a Unit's Table of Road Spaces and Time Lengths.** This format has been prepared for the infantry division

(ROCID). By use of appropriate TOE and the basic formulas contained in *b* above, completed tables can be prepared for any unit.

	1	2	3	4	5	6	7	8	9
LINE	Unit	Actual strength							
		Off and EM	Organic veh	Vehicles not in march colm				Veh in march colm	Men on foot
				Recon party	Dispersed along route	Veh in adv party	Veh in field trains		
1									
2	Inf div (1)								
3	Inf BG (ea) (5)								
4	HQ & HQ co								
5	Mort btry, 105-mm								
6	Rifle co (ea) (4)								
7	Div arty								
8	HQ & HQ btry								
9	FA how bn, 105-mm, towed								
10	HQ & HQ btry								
11	Svc btry								
12	FA how btry, 105-mm, towed (ea) (5)								
13	FA comp bn								
14	HQ & HQ btry								
15	Svc btry								
16	FA how btry, 155-mm, towed (ea) (2)								
17	FA how btry, 8-in, towed								
18	FA msl btry, 762-mm rkt, SP								
19	Cav sq								
20	HQ & HQ trp								
21	Recon trp (ea) (3)								
22	Div HQ & HQ co								
23	Admin co								
24	Avn co								
25	Engr bn								
26	HQ & HQ co								
27	Engr co (ea) (5)								
28	HQ & HQ det and band, inf div tn								
29	Med bn								
30	HQ & HQ det								

See footnotes at end of table

	10	11	12	13	14	15	16	17	18	19	20	21	22	23
LINE	Road space (miles)			Time length (minutes)					Additional veh to carry foot trp (col 9) 2½-T trk)**	Total veh in march col when unit moves by trk (col 8 + col 18)	Road space (miles)		Time length (minutes)	
	Men on foot halted or moving	Vehicles in march col (col 8)		Men on foot			Vehicles in march col (col 8)				Vehicles of units mtz (col 19)		Vehicles of units mtz (col 19)	
				Colm of twos										
1	Colm of twos	Close colm 75 veh/mi 10 MPH	Open colm 20 veh/mi 15 MPH	1½ MPH	2 MPH	2½ MPH	Close colm 75 veh/mi 10 MPH	Open colm 20 veh/mi 15 MPH			Close col 75 veh/mi 10 MPH	Open col 20 veh/mi 15 MPH	Close col 75 veh/mi 10 MPH	Open col 20 veh/mi 15 MPH
2														
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30														

	1	2	3	4	5	6	7	8	9
LINE	Unit	Actual strength							
		Off and EM	Organic veh	Vehicles not in march colm				Veh in march colm	Men on foot
				Recon party	Dispersed along route	Veh in adv party	Veh in field trains		
1									
31	Amb co								
32	Clr co								
33	Ord bn								
34	HQ & main spt co								
35	Fwd spt co								
36	QM co								
37	Sig bn								
38	HQ & HQ co								
39	Comd op co								
40	Plat with main CP								
41	Plat with adv CP								
42	Plat with bde HQ								
43	Plat with tn HQ								
44	Plat with rear ech CP								
45	Fwd comm co								
46	Plat with each BG								
47	Armor bn, 90-mm								
48	HQ & HQ co								
49	Med tk co, 90-mm (ea) (5)								
50	Trans bn								
51	HQ & HQ co								
52	Armd carr co (ea) (2)								
53	Trk trans co								
54	Task forces (ea) (5)								
55	Div tn								
56	Div trp								

* Based on TOE _____, dated _____.

** Based on 20 men per 2½-ton truck with trailer.

General. Use data in d above as guide in completing form.

Columns 2, 3, and 9: Based on periodic reports of subordinate units.

Column 6: Group which normally precedes main body to new area for reception of troops.

Column 7: Vehicles not required for immediate support, such as kitchen, baggage motor maintenance, are designated field trains.

Column 10: Number of men on foot (coln 9) (1) × 1.2 or 2.7 (par. 4.8b(1)) + unit intervals = yards.

Columns 11 and 12: 20 and 21: Numbers of vehicles × factor (par. 4.9c) + time intervals in miles = miles.

Columns 13, 14, and 15: road space (coln 10) × 60

Speed (MPH) = time length (minutes).

	10	11	12	13	14	15	16	17	18	19	20	21	22	23
LINE	Road space (miles)			Time length (minutes)					Additional veh to carry foot trp (col 9) 2½-T trk)**	Total veh in march col when unit moves by trk (col 8 + col 18)	Road space (miles)		Time length (minutes)	
	Men on foot halted or moving	Vehicles in march col (col 8)		Men on foot			Vehicles in march col (col 8)				Vehicles of units mtz (col 19)		Vehicles of un its mtz (col 19)	
				Colm of twos										
1	Colm of twos	Close colm 75 veh/mi 10 MPH	Open colm 20 veh/mi 15 MPH	1½ MPH	2 MPH	2½ MPH	Close colm 75 veh/mi 10 MPH	Open colm 20veh/mi 15 MPH			Close colm 75 veh/mi 10 MPH	Open colm 20 veh/mi 15 MPH	Close colm 75 veh/mi 10 MPH	Open colm 20 veh/mi 15 MPH
31														
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56														

Columns 16, 17, 22, and 23: Number of vehicles X factor (par. 4.9d) + (?) time intervals in minutes = time length (minutes).

Column 18: Number of men on foot (col 9) ÷ 20 except to insure tactical integrity.

¹ In computing men on foot, first consideration is given to the prescribed loads of the vehicles. After this prescribed load is placed on vehicles, the remaining capacity is loaded with personnel.

² Time intervals within a serial average 2½ minutes per 25 vehicles (not considered when serial consists of less than 50 vehicles). Time interval between serials is 15 minutes.

f. *An Example of a Table of Time Distances.* Precomputed tables of time distances for routine rates of march will simplify calculations.

An example of such a table based on 15 mph follows:

Distance traveled ↓	0	1	2	3	4	5	6	* 7 ↓	8	9
0	0	4	8	12	16	20	24	28	32	36
10	40	44	48	52	56	60	64	68	72	76
20	80	84	88	92	96	100	104	108	112	116
30	120	124	128	132	136	140	144	148	152	156
40	160	164	168	172	176	180	184	188	192	196
50	200	204	208	212	216	220	224	228	232	236
60	240	244	248	252	256	260	264	268	272	276
70	280	284	288	292	296	300	304	308	312	316
80	320	324	328	332	336	340	344	348	352	356
90	360	364	368	372	376	380	384	388	392	396
100	400	404	408	412	416	420	424	428	432	436
110	440	444	448	452	456	460	464	468	472	476
120	480	484	488	492	496	500	504	508	512	516
130	520	524	528	532	536	540	544	548	552	556
140	560	564	568	572	576	580	584	588	592	596
150	600	604	608	612	616	620	624	628	632	636
160	640	644	648	652	656	660	664	**668	672	676
170	680	684	688	692	696	700	704	708	712	716
180	720	724	728	732	736	740	744	748	752	756
190	760	764	768	772	776	780	784	788	792	796
200	800	804	808	812	816	820	824	828	832	836
210	840	844	848	852	856	860	864	868	872	876
220	880	884	888	892	896	900	904	908	912	916
230	920	924	928	932	936	940	944	948	952	956
240	960	964	968	972	976	980	984	988	992	996
250	1,000	1,004	1,008	1,012	1,016	1,020	1,024	1,028	1,032	1,036
260	1,040	1,044	1,048	1,052	1,056	1,060	1,064	1,068	1,072	1,076
270	1,080	1,084	1,088	1,092	1,096	1,100	1,104	1,108	1,112	1,116
280	1,120	1,124	1,128	1,132	1,136	1,140	1,144	1,148	1,152	1,156
290	1,160	1,164	1,168	1,172	1,176	1,180	1,184	1,188	1,192	1,196
300	1,200	1,204	1,208	1,212	1,216	1,220	1,224	1,228	1,232	1,236

** Illustrations of use.

PROBLEM. What is the time distance of a vehicle moving between points A and B, which are 167 miles apart, at a rate of 15 mph?

ANSWER. Enter left-hand column at 160, move across to the vertical line under 7, and read the time distances of 668 minutes directly from the table.

g. *Average Time Factors—Infantry Division.*

(1) These data pertain to G3 time factors considered after a division receives a movement order. They give the times required by the command for—

(a) Making preparations before the leading vehicle can arrive at the start point.

(b) Completing the motor march and making preparations to launch a coordinated attack.

(2) The preparations before the leading vehicle can arrive at the start point include transmission of orders by division; assembling trucks; spotting trucks; map reconnaissance of routes, detrucking areas, and assembly areas; issue of extra ammunition; briefing of troops; and other normal preparations for an anticipated movement. This preparation pertains to the *first* trip, whether the division is completely motorized by attached transportation and moves in one trip, or whether the

division moves by organic transportation in two or more trips (echelon). The earliest time in which the leading vehicle can pass the start point after receipt of the order by the division commander is—

	Hours
(a) If the order was received in daylight for a daylight march, for example, received at 1000, leading vehicle can cross the start point at 1130 -----	1½
(b) If the order was received at night for a night march, for example, received at 2200, leading vehicle can cross the start point at 2400 -----	2
(c) If the order was received in daylight for a night march, for example, received at 1100, leading vehicle can cross the start point 1 hour after EENT (For EENT, see par. 3.13f.) -----	1 hour after EENT
(d) If the order was received at night for a daylight march, and more than 2 hours prior to BMNT, for example, received at 0200, leading vehicle can cross the start point at BMNT -----	BMNT
(For BMNT, see par. 3.13f.)	

(If the order was received less than 2 hours prior to BMNT, the time is the time the order was received plus 2 hours.)

Note. To determine corresponding time factors for a foot march instead of a motor march, use ½ hour less in (a), (b), and (c) above.

- (3) The factors considered in computing time to complete a march and to make preparations for launching a coordinated attack are dependent upon whether the march is made by echelon or completed in one trip. The following time factors in (a), (b), (c), and (d) below are applicable only when the march is made by echelon. The time factors shown in (e), (f), (g), (h), and (i) below, apply to any motor move and outline the procedure used in determining the earliest time at which an infantry division can launch a coordinated attack. These factors are based upon the assumption that the infantry division can launch a coordinated attack when each of the battle group task forces participating in the coordinated attack is in position behind the line of departure. Since the closing of these battle group task forces requires more time than the preparation and movement of the other forces, supporting units, such as artillery, reserves, etc., will be in position prior to closing of the battle group task forces on the line of departure. The factors are further based upon the assumption that these assault forces will be the leading elements of the road movement serials.

	Day	Night
(a) Dump prescribed loads -----	15 min	30 min
(b) Load prescribed loads -----	30 min	60 min
(c) Reassemble trucks for each trip made in convoy -----	20 min	40 min
(d) Entruck personnel -----	10 min	20 min
(e) Complete the motor march from the old area to the new area --	See above.	

Note. If the release point (RP) is 3 miles or less from the detrucking point (DP), time distance will be the time to complete the move from the start point to RP. Any consideration of time consumed in moving by motor from the RP to the DP in the new area is included in the time factors given in (g)

below. If the distance is over 3 miles from RP to DP, the time to traverse this distance must be added to the time required to complete the move from the start point to the RP before considering the time factor for detrucking troops in (f) below.

	Day	Night
(f) Detruck, reform foot troops -----	5 min	10 min
(g) Organization and movement in the new assembly area prior to troops reaching the foot start points for the foot march to the line of departure. (This includes movement from the RP as outlined in (e) above as well as time to issue any additional rations or ammunition carried in each truck transporting troops.) -----	30 min	60 min
(h) Time to move from foot start points in the new area to line of departure (time distance of foot march.) -----	See paragraph 4.8d(1)	
(i) Time for final preparation after the leading man reaches the line of departure and prior to launching a coordinated attack. (This factor includes time to close foot troops behind the line of departure, time to reconnoiter, issue orders in subordinate units, and emplace and register infantry weapons where necessary.) -----	60 min	90 min

h. Average Time Factors—Armored Division.

(1) This table pertains to G3 time factors considered after an armored division receives a movement order. It gives the times required by the command for —

- (a) Making preparations before the leading vehicle can arrive at the start point.
- (b) Completing the motor march and making preparations to launch a coordinated attack.

(2) The preparations before the leading vehicle can arrive at the start point are less time consuming than in the infantry division since the armored division is able to move the entire division by organic vehicles. Preparations include transmission of orders by division, briefing of troops, and other normal preparations for an anticipated move. It is standing operating procedure (SOP) for armored division vehicles to be refueled and expended ammunition replaced at once whenever a halt is made or any element of the division enters an assembly area, thus permitting vehicles to move as soon as personnel and equipment are loaded.

Hours

- (a) If the order was received in daylight for a daylight march, for example, received at 1000, leading vehicle can cross start point at 1045 -- $\frac{3}{4}$ hr
- (b) If the order was received at night for a night march, for example, received at 2200, leading vehicle can cross the start point at 2300 ----- 1 hr
- (c) If the order was received in daylight for a night march, for example, received at 1100, leading vehicle can cross start point 30 minutes after EENT—30 minutes after EENT. (For EENT, see par. 3.13f.)
- (d) If the order was received at night for a daylight march, and more than 1 hour prior to BMNT, for example, received at 0200, leading vehicle can cross start point at BMNT—BMNT. (See par. 3.13f(1).) (If order was received less than 1 hour prior to BMNT, the time is the time the order was received plus 1 hour.)
- (3) The factors considered in computing time for an armored division to complete a march and make preparations for launching a coordinated attack are dependent upon whether the

armored division is organized for combat. Generally, it is assumed, unless otherwise stated, that the division is organized for combat in anticipation of the move and commitment to battle. The time factors (b) and (c) apply to any move and are based on the assumption that the division can launch a coordinated attack when 2 reinforced battalions (equivalent of 1 infantry battalion and 1 tank battalion) of each combat command are in position to attack. If the division formation is a column of combat commands, only the time factors for the leading combat command are computed. If the division formation is combat commands abreast, the time factors for the combat command with the greatest distance to traverse are computed as the factors for the entire division. If an

armored division is not organized for combat, time must be allowed (as included in (a) below) to permit battalions and supporting units to assemble under a combat command and organize into reinforced battalions under the combat command commander. Other commands, such as the combat command in reserve, division troops, division artillery, division trains, and units placed in division troops, can be assumed to complete their organization in less time than a combat command and therefore are not included as a factor. The organization of combat commands and reinforced battalions may be partially or entirely completed either in bivouac, assembly area or attack position, or a combination thereof. The time factor, however, remains the same.

	Day	Night
(a) Organize combat commands and reinforced battalions. (In either one or combination of bivouac, assembly area and attack position, and attack position) -----	45 min	1 hr 30 min
(b) Complete march from old area to new area -----	See (3) above.	
(c) Time for final reconnaissance, refueling, and preparations to cross the line of departure or leave attack position (may be a combined assembly area-attack position) -----	30 min	1 hr

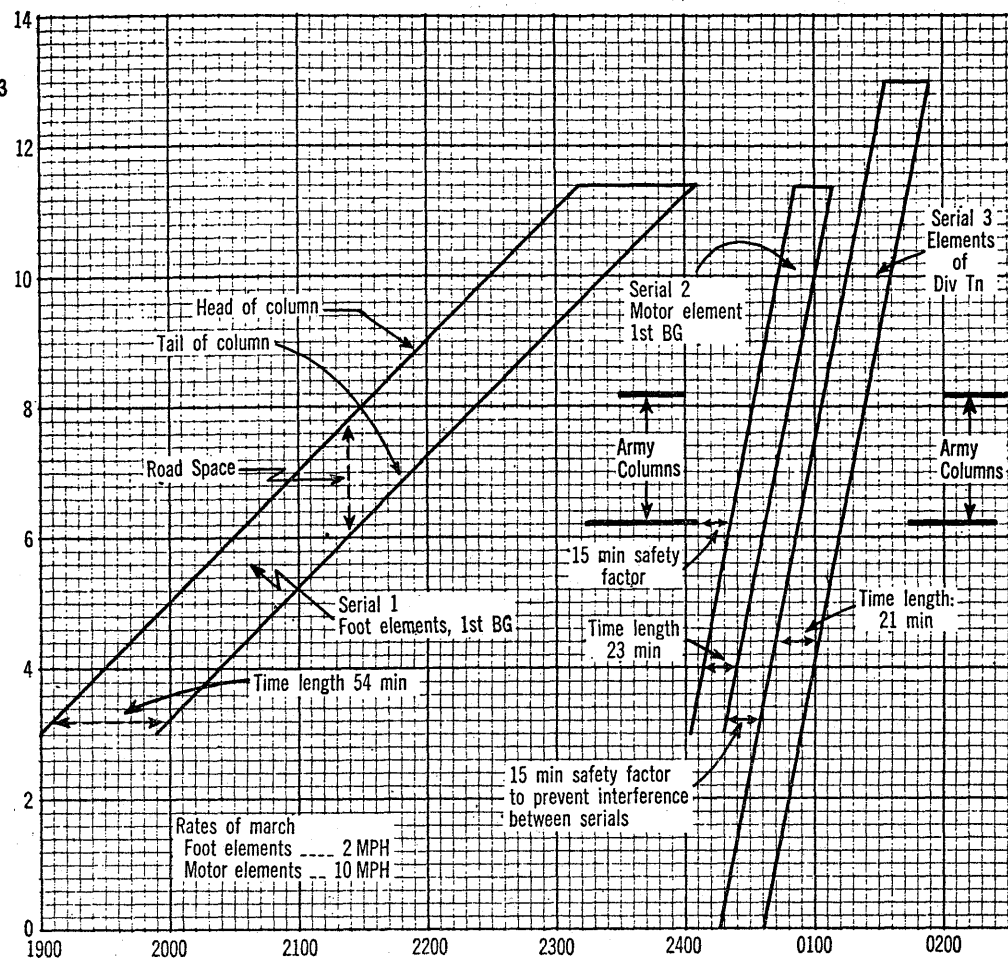
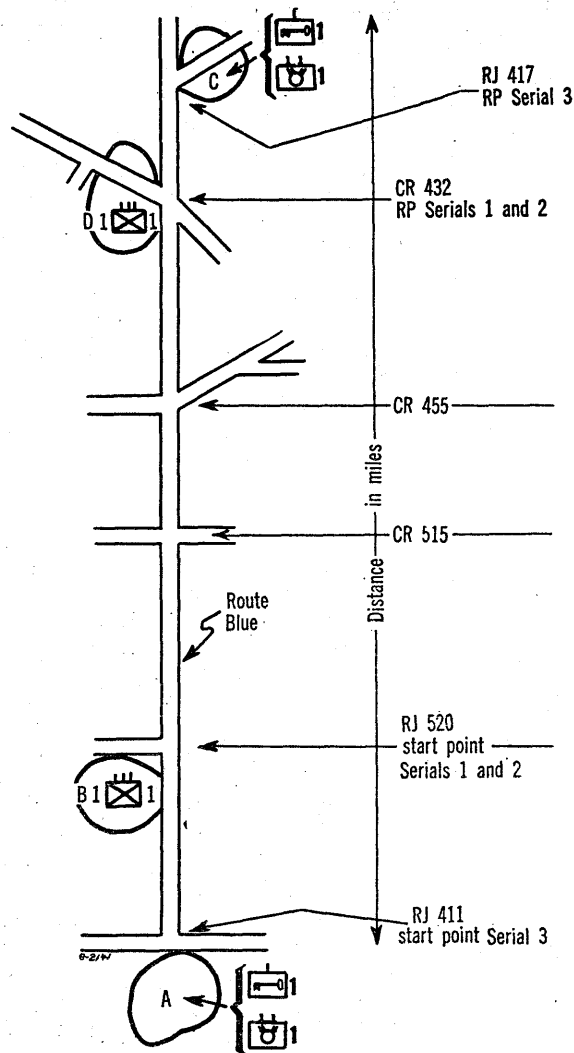
i. Road Movement Graphs.

- (1) A road movement graph is the simplest method of obtaining data required for a road movement table or order. It shows the approximate location at any hour of the head or tail of each serial, providing the road movement proceeds as scheduled. The vertical scale to the left, with point of origin at the bottom, serves as a distance scale in miles and should show the relative locations, along the route, of critical points where coordination of the movement is required. The horizontal scale provides a time scale in hours, beginning at the left with the earliest hour at which the first serial may start the march.
- (2) A serial is represented graphically by drawing a line to represent the movement of the head of the serial and a

line to represent the movement of the tail of the serial. The lines are parallel and are drawn with a slope that represents the rate of march. (At 10 miles per hour, the slope equals 10 miles on the vertical to 1 hour on the horizontal scale.)

- (3) *Example of road movement graph.*
 - (a) The 1st Infantry Division commander has directed that elements of the 1st Ordnance Battalion, 1st Quartermaster Company, and of the 1st Battle Group (reinforced), 1st Infantry, move under cover of darkness from their present bivouacs, areas A and B, to areas C and D. Foot troops and motor vehicles will move during the night 27-28 October. Movement is to begin 271900 October and is to be completed 280430 October.

(b) Road movement graph.



j. Road Movement Table.

(1) *General.* A road movement table is normally published as an annex to the march or operation order. The road movement table contains information and instructions concerning the march serials involved in the movement, their serial numbers, rates of march, routes, start points, times of crossing the start points, RP, critical points, times of arrival at or departure from critical points, and other pertinent details. This information is usually obtained from an accurate knowledge of the status of routes and units and from a road movement graph (*i* above). If

desired, some of the information contained in the road movement table may be determined by march calculations. The road movement table usually consists of two parts: a data paragraph reflecting general information, or information common to two or more serials; and a tabular list of the march serials, together with all other necessary information regarding them. Road movement tables will frequently require a wider distribution than a march or operation order so that copies can be issued to movement control personnel, military police traffic posts, and the like.

(2) Example of road movement table.

(Classification)

Normal opO heading

Annex (Road Movement Table) to OpO

Reference: Map, ***.

1. Average or maximum speed.

2. Traffic density (type march column).

3. Halts.

4. Routes between start points (SP) and release points (RP).

5. Critical points.¹

(a) Start points.

(b) Release points.

(c) Other critical points.

6. Main routes to start points.¹7. Main routes from release point.¹

1 ²	2	3	4	5	6	7	8	9	10	11			12	13
Serial	Date ³	Organization and commander	No. of vehicles	Load class of heaviest vehicles	Present ³ location	Route ¹	New ³ location	Route to start point	TL (min)	Control of movement			Route from release point	Remarks
										Location of critical points ⁴	Arrival time	Clearance time		
1	***	TF 1/61, Col Johns, 61st Inf, Comdr	***	***	SAARBURG area	RED	METZ area	***	75	SP RJ (THIONVILLE) METZ RP DP	*** *** *** *** ***	*** *** *** *** ***	***	***
2	***	TF 2/62, Col Smith, 62d Inf, Comdr	***	***	SAARBURG area	RED	METZ area	***	45	SP RJ (THIONVILLE) METZ RP DP	*** *** ***	*** *** ***	***	***
3	***	TF 3/63, Col Dunn, 63d Inf, Comdr	***	***	SAARBURG area	BLUE	METZ area	***	95	SP BIBICHE Bridge RJ (BOUZONVILLE) RP DP	1730 1746 1810 1922 1954	1905 1921 1945 2057 2129	***	***
4	***	Div Trp, Col Short, Div Arty, Comdr	***	***	SAARBURG area	BLUE	METZ area	***	154	SP BIBICHE Bridge RJ (BOUZONVILLE) RP DP	1920 1936 2000 2112 2144	2150 2206 2220 2342 0014	***	***
5	***	Div Tn, Lt Col Evans, 20th Ord Bn, Comdr	***	***	SAARBURG area	BLUE	METZ area	***	65	SP BIBICHE Bridge RJ (BOUZONVILLE) RP DP	2205 2229 2305 0053 0117	2310 2334 0010 0158 0222	***	***
		TF 4/64, Col Henry,								SP RJ (SAARLAUTERN)	*** ***	*** ***		

6	***	64th Inf, Comdr	***	***	SAARBURG area	YELLOW	METZ area	***	75	RJ (ST AVOLD) RP DP	*** *** ***	*** *** ***	***	***
7	***	TF 5/65, Col Pickett, 65th Inf, Comdr	***	***	SAARBURG area	YELLOW	METZ area	***	45	SP RJ (SAARLAUTERN) RJ (ST AVOLD) RP DP	*** *** *** *** ***	*** *** *** *** ***	***	***

Acknowledge ⁵

Appendixes

Commander⁵

Distribution

Authentication

(Classification)

¹Routes and points are described in the data paragraphs by grid references, code words, etc., and, if necessary, numbered or lettered for ease of reference in the columns below.

²Only the minimum number of columns of the table should be used.

³As the table may be issued to personnel concerned with control of traffic, the security aspect must be remembered. It may not be desirable to include dates or locations.

⁴Critical point is defined as a selected point along a route used for reference in giving instructions. It includes start points, release points, and other points along a route where interference with movements may occur.

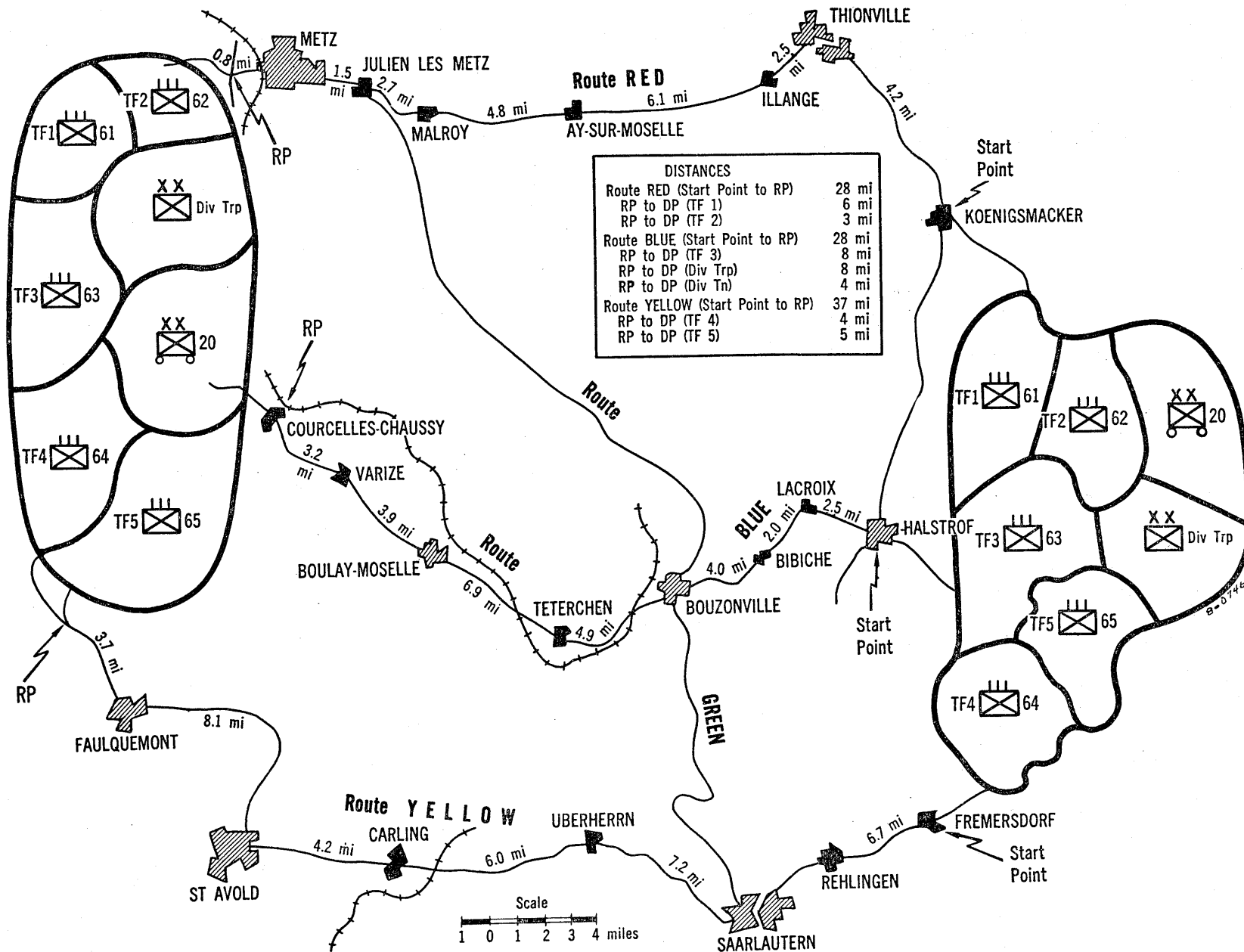
⁵If the table is issued by itself, and not as an annex to a more detailed order, the table must be signed or authenticated in the normal way.

k. Strip Map.

(1) *General.* A strip map is a schematic sketch of the routes of march that contain useful information concerning them. A strip map should be included as an annex to the march order issued by the division, combat command, or

battle group. It is particularly useful to small unit commanders for organization control. Strip maps should be reproduced in quantity by using units and supplied to key personnel, particularly to vehicle commanders and route markers.

(2) Example of strip map.



l. Vehicle Availability Table.

(1) *General.* The vehicle availability table is used in planning the movement of an infantry division by means of its own organic transportation. It helps the transportation officer make a plan for drawing 2½-ton or 5-ton trucks from subordinate units of the division in accordance with their ability to furnish them. Across the top of the table are listed all the subordinate units of the division except the cavalry squadron. This unit is omitted because its vehicles are not normally available. In column 1, the 2½-ton and 5-ton trucks of the division are divided into priorities of availability according to their normal uses. When the transportation officer levies on units for trucks, he will deplete each priority, starting with the highest, until he obtains the required number

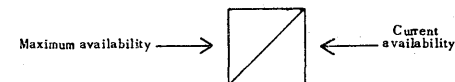
of vehicles. All of the 2½-ton and 5-ton trucks of the division do not appear on the table. The prime movers, maintenance vehicles, command and fire control vehicles, and essential signal communication vehicles are omitted because it is not intended that these vehicles ever be used for general cargo hauling or for transporting troops of other units. For any given move, the number of vehicles actually available will vary because of dead-lined trucks, combat losses, and restrictions applicable to the move under consideration. Using the vehicle availability table and the troop strengths of the units requiring additional transportation, the number and source of vehicles required for the march can be quickly and accurately determined.

(2) Example of vehicle availability table.

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	
Priority	Normal use	1st BG, 61st Inf	2d BG, 62d Inf	3d BG, 63d Inf	4th BG, 64th Inf	5th BG, 64th Inf	HQ&HQ Btry, Inf Div Arty	1st How Bn (105-mm), 45th Arty	1st FA Bn (Rkt/How), 46th Arty	20th Engr Bn	1st Med Tk Bn, 1st Armor	HQ Co, Inf Div	20th QM Co	20th Med Bn	20th Ord Bn	20th Sig Bn	20th ¹ Trans Bn	20th Admin Co	20th Avn Co	HQ&HQ Det, 20th Inf Div Tn	Total div	
		Max																				Max
		Aval																				Aval
1	Sup and gen cargo	0	0	0	0	0	0	0	0	4	6	0	0		3	1	80	3	0		97	
2	Org eqp	0	0	0	0	0	4	0	3	5	0	0	6		1	0	0	0	0	1	20	
3	Ki trk	5	5	5	5	5	1	7	6	6	6	2	1	4	2	3	4	2	1	1	71	
4	Engr tool and brg	3	3	3	3	3	0			44											59	
5	Ammo trk	10	10	10	10	10	0	15	22	4	13										104	
6	Sig comm	0	0	0	0	0	3	1	1	1						40					46	
	Total	18	18	18	18	18	8	23	32	64	25	2	7	4	6	44	84	5	1	2	397	

¹ The transportation battalion includes in addition 2 armored carrier companies, consisting of 114 carriers, personnel, full-tracked, armored (M59) type, that are not shown on the table. Based on 75 percent vehicle availability, these companies can transport 880 personnel or 120 tons of cargo in 1 lift.

L8-2141-58



m. Vehicle Assignment Table.

- (1) *General.* The assignment table shows from what units the vehicles will be drawn and to what units they will be

assigned for the move. This table is based on the vehicle availability table (l above).

- (2) *Example of vehicle assignment table.*

1	2	3	4	5	6	7
Unit from which transport is furnished	Number of 2½-ton or 5-ton trucks provided and unit to which furnished					
	1st echelon ¹			2d echelon		
	TF 1	TF 3	TF 4	TF 2	TF 5	Elm div trp ² and div tn
2 TF 1.....				22		
3 TF 3.....				22		
4 TF 4.....					22	
5 TF 2.....		5				
6 TF 5.....	5					
7 HQ Btry, Div Arty.....				1	3	
8 1st FA Bn (Rkt/How).....					20	
9 20th Engr Bn.....		5				
10 20th Sig Bn.....	2					
11 20th QM Co.....	5					
12 20th Ord Bn.....		5				
13 20th Trans Bn.....	30	30	(3)			
14 Admin Co.....	3					
15 Total.....	45	45	0	45	45	

¹ The division troops that move with the first echelon are completely mobile. The administrative equipment of these troops that cannot be transported on organic transportation will be moved by transportation battalion trucks with elements of division troops in the second echelon.

² The 2½-ton trucks in the transportation battalion will be used to assist the movement of all units in division troops and division trains that are not 100 percent mobile.

³ The 2 armored carrier companies will be attached to 1 battle group task force for movement of personnel and equipment for which no organic transportation has been provided. Based on 75 percent vehicle availability, 2 armored carrier companies normally have 80 armored carriers operational at any given time.

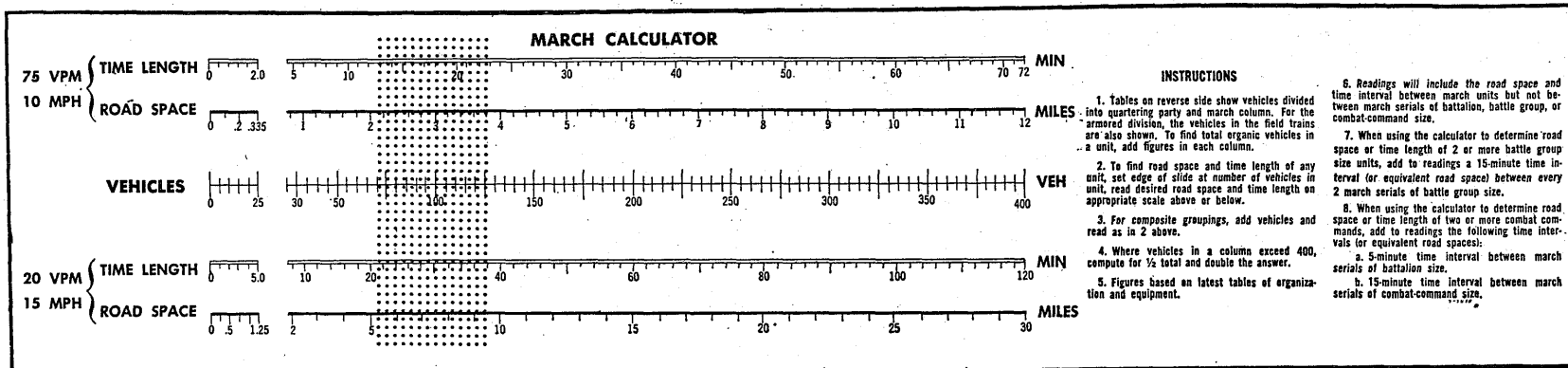
n. March Calculator.

- (1) *General.* A march calculator is a special form of a slide rule. The desired road space or TL of any unit can be read directly from the calculator, providing the number of vehicles in the unit column is known. The calculator readings include the road space or TI between march units but not those between march serials of battalion, battle group, or combat command size. When using the calculator to determine road space or time length of 2 or more infantry battle

groups, add to readings a 15-minute time interval (or equivalent road space) for every interval between march serials of battle group size. When using the calculator to determine road space or time length of two or more combat commands, add to readings the following time intervals (or equivalent road spaces):

5-minute time interval between march serials of battalion size.
15-minute time interval between march serials of combat command size.

(2) Example of march calculator.



BASIC ARMORED UNITS

ORGANIC VEHICLES	Quartering party	Field train	March column
ARMORED DIVISION (FULL STRENGTH)			
Armd Div Total	3,457		
Armor Bn (90-mm)	14	26	163
Med Tk Co		1	24
Armd Inf Bn	14	18	148
Rifle Co		1	23
FA How Bn (105-mm) (SP)	6	12	114
FA How Btry (105-mm) (SP)	1	1	20
Armd Div FA Comp Bn	6	12	130
FA How Btry (155-mm) (SP)	1	1	21
FA How Btry (8-in) (SP)	1	1	20
FA Msl Btry (762-mm Rkt) (SP)	1	1	26
Engr Bn	6	15	218
Engr Co	1	1	28
Engr Brg Cpl	1	1	51
Engr Brg Plat			16
Armd Cav Sq	5	13	242
Recon Trp	1	1	43
MP Co			5
MP Plat			3
Sig Bn	28	12	101
Comd Op Co	14	12	26
Fwd Comm Co	13	28	
CC Area Spt Plat	4		9
HQ and HQ Co, Armd Div	7	37	
HQ and HQ Co, CC	6	1	29
HQ and HQ Btry, Div Arty	6		43

¹ Dispersed along route.

BASIC INFANTRY UNITS

ORGANIC VEHICLES	Quartering party	Field train	March column
INFANTRY DIVISION (FULL STRENGTH)			
Inf Div Total	2,220		
HQ & HQ Co, Inf Div	12	8	33
Bde HQ			6
BG	9	121	
HQ & HQ Co	4	67	
Mort Btry (105-mm)	1	26	
Rifle Co	1	7	
Inf Div Arty	18	347	
HQ & HQ Btry	4	45	
FA How Bn (105-mm)	7	174	
FA How Btry (105-mm)	1	26	
FA Comp Bn	7	128	
FA How Btry (155-mm)	1	18	
FA How Btry (8-in)	1	19	
FA Msl Btry (762-mm Rkt) (SP)	2	25	
Engr Bn	14	6	141
Engr Co		1	16
Med Bn	2	55	
Amb Co		40	
Clr Co		7	
Ord Bn	2	96	
HQ and Main Spt Co	1	43	
Fwd Spt Co	1	53	
Plat, Fwd Spt Co		6	
QM Co	1	60	
Cav Sq, Inf Div	5	155	
Recon Trp	1	34	
Sig Bn	12	133	
Comd Op Co		10	47
Fwd Comm Co			51
Plat, Fwd Comm Co			10
Armor Bn (90-mm), Inf Div			6
Med Tk Co (90-mm)			1
HQ & HQ Det, Inf Div			1
Tn and Band			1
Trans Bn			1
Trk Trans Co			85
Armd Carr Co			57
Admin Co			1
Avn Co			2
Det, Avn Co			1
BG TF ²			12
Div Trp ³			34
Div Tn ⁴			11

² Does not include veh to mtz foot elm.

³ Does not include Recon Sq.

⁴ Does not include 114 M59 (2 Armd Carr Co).

4.11. Motor Movement by Echelon

a. *Definition.* Motor movement by echelon is a movement in which a unit, such as an infantry division, lacking sufficient organic transportation to move all its personnel and equipment in one trip, uses a portion of its transportation to move its foot troops and essential supplies (by complete tactical units) in successive trips until the movement of all has been completed.

b. *Sequence.* The sequence of events can be briefly shown in terms of time consumed as follows:

- (1) Preparation time (first echelon).
- (2) TD (each route).
- (3) TL (close entire first echelon) .
- (4) Unload.
- (5) Reassembly.
- (6) TD (each route).
- (7) TL (returning trucks).
- (8) Load.
- (9) Reassembly (head of column at start point).
- (10) TD (each route).
- (11) TL (close entire second echelon).

c. *Basic Principles.* Although vehicles must be utilized to the maximum in a movement by echelon, there are certain basic principles to be observed if the combat efficiency of the division is to be maintained. These are as follows:

- (1) In levying on units for transportation, exclude weapons carriers, prime movers, maintenance trucks, and essential command, reconnaissance, and communication vehicles. Units must retain their battlefield mobility and effectiveness.
- (2) Leave sufficient ammunition vehicles with units moved in the first echelon to enable them to conduct operations until supply can be instituted. It is preferable that these units have the use of all their ammunition vehicles. However, they are normally allowed to retain at least two-thirds of them.
- (3) Normally, provide for the field trains to march with their parent organizations. Field trains consist of kitchen, baggage, and administrative vehicles and such fuel, medical, and maintenance vehicles as are not part of the combat trains. Upon arrival in the new area, field train vehicles in the

first echelon, assigned for movement of the second echelon, dump their prescribed loads and return to assist in the movement of that echelon.

- (4) Avoid dumping the prescribed loads of a large number of vehicles in the forward area.
- (5) Employ as a group vehicles taken from a unit wherever possible in order to facilitate control and maintenance by the parent unit.
- (6) Employ vehicles from other elements of a unit to move the foot troops of that unit whenever possible. Similarly, vehicles from units usually associated in a task force should be used to move the foot troops of that task force.
- (7) Use only 2½-ton or 5-ton trucks, including dump trucks, unless otherwise prescribed, to move foot troops.

d. *SOP.* Since motor movement by echelon requires careful planning, it is advisable for a division to have several plans prepared in the form of an SOP. Time for planning such moves will nearly always be short. In such a situation, to modify an existing plan is much quicker than to prepare an entirely new one. SOP plans should contain—

- (1) A plan number.
- (2) A standard composition for the division security force.
- (3) A standard composition and duties of quartermaster (advance) party.
- (4) The units to move in each echelon.
- (5) Organization of columns.
- (6) The assignment of vehicles to move foot troops and impedimenta, showing the unit from which obtained and the unit to which assigned for the move.
- (7) Adequate provisions for signposting and traffic control.

e. *Time Formula.* When time precludes detailed planning, such as outlined above, the following formula may be useful in rapidly estimating the total time of such a movement:

$$\text{Hours required} = \frac{\text{Number of trips} \times \text{distance in miles}}{\text{Rate of march in miles per hour}} + T$$

- (1) The "number of trips" is the number of trips in either direction; for example, in a 2-echelon movement, 3 trips would be required—1 forward trip to move foot troops, a return trip,

and a second trip forward for the remainder of troops and organic loads.

- (2) T (a variable) represents the number of hours consumed in unloading and loading personnel and equipment, in turnarounds at forward and rear assembly areas, and in closing the column into its area of destination. When 2 routes are available and the movement is made in close column in 2 echelons, a value of 6 may be assumed for T, as giving a reasonable factor of safety. When more than two routes are available, the value of T may be reduced.
- (3) "Rate of march in miles per hour" represents the average speed of the vehicles in the movement over a period of time, including short halts.

4.12. Movement by Air

a. General.

- (1) The tables in this paragraph may be used as a general guide to determine the aircraft requirements, by type of transport aircraft, for air movement of nondivisional units of the type field army. For the aircraft requirements for air movement of airborne and infantry divisions or their organic units, see TT 57-100-30. The following tables are based on data compiled for a theoretical situation which assumes full TOE strength and complete TOE equipment. Tonnage figures are estimates only. In applying these tables to actual air movements, bear in mind that the required lift for any unit will fluctuate with the personnel and equipment status of that unit. The tables show numbers of aircraft loads; i.e., the number of sorties, by type of aircraft, required to move a particular unit. Fewer aircraft than shown may be used to transport the unit if part or all of the aircraft fly more than one sortie.
- (2) The air movement of a large body of troops normally will involve departures from several airfields and, in air-landed operations, concurrent landing at several terminal airfields, air-

landing facilities, or landing zones in the objective area. The availability of transport aircraft, air installations, and base facilities; the urgency of the situation; and enemy capabilities will be major factors which will determine the number of installations employed as well as the number of sorties to be flown by the transporting aircraft. For considerations governing the employment of air transportation, see FM 100-5 and TT-100-30. For staff procedures, air movement tables, and other forms relative to air movement, see TT 57-100-30, FM 101-5, TM 57-210, and TM 57-210A.

b. Aircraft Requirements—Army.

- (1) *General.* The tabulated data in (4)-(a), (b), and (c) below, represent aircraft requirements for units of a type field army. The data are a guide only in planning for airborne operations or the administrative air movement of units of the type field army.

(2) *Equipment and supplies.*

- (a) *General.* Column 3 of these tables indicates the total weight of each unit in short tons. This figure is the sum of the weights of TOE personnel and equipment, class I supply for 3 days, and prescribed loads of classes III and V supply. The prescribed loads of class V supply may be the same, more or less than the basic loads of class V, since they are determined separately for each specific airborne operation.
- (b) *TOE personnel and equipment.* Unless otherwise indicated, all units are moved at 100 percent personnel and equipment strength. An average weight of 240 pounds per individual is used in determining total personnel weight for a unit. Weights of vehicles are determined by use of net weights given in TM 9-2800, or applicable technical manuals.
- (c) *Supply.* The major classes of supply considered are classes I, III, and V. The accompanying class II and IV supplies are limited to critical items and are usually in such small

amounts that their weights are incidental and therefore are not included.

1. Class I supply is based on 3 days to accompany each unit with an average weight of 6.6 pounds per man per day.
2. Class III supply is based on the weight of gasoline, oil, and lubricants required to operate vehicles a minimum of 300 miles. Class III requirements for other self-propelled equipment and for fuel-consuming machinery are established on a reasonable hourly operational basis for 3 days.
3. Class V supply weights are based on the basic load for all units adjusted to a reasonable rate of consumption so as to reflect 3 days of class V supply. The weights of class V supply for some army units have not been included. They are too small to be significant, because the greater part is carried by the individual.

(3) *Aircraft requirements.*

- (a) Aircraft requirements listed in (4) (a), (b), and (c) below reflect the number of sorties required to transport the various units.
- (b) The figures in column 6 (C-130) were computed by applying a conversion factor to the figures in column 5 (C-119, C-123). Medium aircraft requirements are determined by using *either* column 5 *or* column 6, but not by adding the two columns.
- (c) The aircraft requirements are based on the following assumed allowable cargo loads.

<i>Type aircraft</i>	<i>Allowable cargo load (lb)</i>
C-119, medium transport airplane-----	16,000
C-123, medium assault transport airplane-----	16,000
C-130, medium transport airplane-----	25,000
C-124, heavy transport airplane-----	42,000

- (d) The same allowable cargo load is used for the C-119 and C-123 to facilitate interchanging of loads for planning purposes on a 1 for 1 basis.

- (e) Air Force troop carrier units, providing aircraft for the specific operation being considered, will announce to the Army component of the airborne force the allowable cargo load for each type aircraft that will be employed, because the allowable cargo load will vary with the distance to be flown and other operational conditions.
- (f) In any airborne operation, it may be necessary to use types of aircraft other than those listed. However, the data given will serve as a basis for adaptation of the units to be moved to the types of aircraft that are available.
- (g) Two loading methods are indicated in column 4.
 1. The first load method indicates the aircraft requirements for a given unit when the maximum number of medium aircraft are used. In the event the unit contains heavy or bulky items transportable only in heavy aircraft, the figure in column 7 indicates the minimum number of heavy aircraft required.
 2. The second load method indicates the aircraft requirements when the entire unit is transported in heavy aircraft. If a unit contains equipment not transportable by this class airplane, movement by other means of transportation is required. If accomplishment of the primary mission of the unit is dependent upon the availability of such heavy equipment, it may be necessary to substitute lighter items which are capable of performing similar missions. The heavy tank battalion is an example of a unit with heavy equipment which is nontransportable by heavy transport airplanes.
 3. Units in which the first load method has been omitted are those having quantities of heavy or bulky equipment that preclude efficient loading in medium as-

sault or medium transport aircraft.

- (h) In selection of a load method by which to transport a unit, careful consideration must be given to the primary mission of the unit and the requirement for the unit in the airhead. During the initial airborne assault, units transported to the objective area will utilize a combination of parachute and assault air-

craft. Subsequent to the initial assault and after landing facilities have been prepared, medium transport aircraft may be used. When facilities are developed sufficiently to handle heavy transport airplanes, units requiring this means of transportation can be phased into the airhead.

(4) *Tabulated requirements—Army.*

(a) *Headquarters and divisions.*

1	2	3	4	5	6	7	8
Unit	TOE	Total weight unit in short tons	Load method	Aircraft requirements			Remarks
				C-123 C-119	C-130	C-124	
HQ & HQ co, army ¹ -----	51-1C-2C	277	1	35	23	15	See TT 57-100-30 See TT 7-100-2
HQ, sp trp, army ¹ -----	51-3C	16	2	2	2	1	
HQ & HQ co, corps ¹ -----	52-1C-2C	167	1	21	14	9	
Abn div-----			2				
Inf div-----							

¹ Unit designations and TOE numbers only are current. Short-ton weights do not reflect recent TOE changes and should be used as a guide only.

(b) *Branches.*

1	2	3	4	5	6	7	8
Unit	TOE	Total weight unit in short tons	Load method	Aircraft requirements			Remarks
				C-123 C-119	C-130	C-124	
Armored: ¹							
Armd cav regt-----	17-51R	8,214	1	326	209	266	Light tanks substituted for medium tanks
			2			392	
HQ & HQ co, armd cav regt-----	17-52R	336	1	24	16	8	
			2			18	
Svc co, armd cav regt-----	17-53R	782	1	74	48	10	
			2			48	
HQ & HQ co, armd cav recon bn-----	17-56R	202	1	10	7	6	
			2			11	
Recon co, armd cav regt-----	17-57C	410	1	14	9	15	
			2			21	
Armd FA btry, 105-mm how, SP-----	6-317C	334	1	14	9	11	
			2			17	
Tk co, 90-mm gun-----	17-27C	575	1	13	9	23	Light tanks substituted for medium tanks
			2			29	
Tk co, 76-mm gun, sep (sp)-----	17-17R	627	1	20	13	23	
			2			32	
Tk bn, 120-mm gun-----	17-35C	2,999	1	75	48	112	Light tanks substituted for medium tanks.
			2			143	
HQ, H & S co, tk bn, 120-mm gun-----	17-36C	784	1	43	28	21	Light tanks substituted for medium tanks.
			2			39	

See footnotes at end of chart.

1	2	3	4	5	6	7	8
Unit	TOE	Total weight unit in short tons	Load method	Aircraft requirements			Remarks
				C-123 C-119	C-130	C-124	
Armored ¹ (contd)							
Tk co, 120-mm gun-----	17-37C	737	1	18	12	29	Light tanks substituted for medium tanks.
			2			36	
HQ & HQ co, armor gp-----	17-32R	73	1	10	7		
			2			5	
Artillery: ¹							
HQ & HQ btry, corps arty-----	6-501C	250	1	31	20		
			2			12	
HQ & HQ btry, FA gp-----	6-401C	136	1	18	12		
			2			8	
FA obsn bn-----	6-575C	1,197	1	102	66	18	
			2			58	
FA slt btry-----	6-558C	143	1				Not transportable in medium aircraft without major disassembly of major items.
			2			10	
FA bn, 105-mm how, SP, armd-----	6-315C	1,537	1	49	32	55	Veh tk recovery not air transportable.
			2			73	
FA bn, 155-mm how, towed-----	6-135C	868	1	81	52	12	
			2			42	
FA bn, 155-mm how, SP, armd-----	6-325C	1,746	1	50	32	65	Veh tk recovery not air transportable.
			2			84	
FA bn, 155-mm gun, towed-----	6-415R	1,698	1	87	56	48	
			2			81	
FA bn, 155-mm gun, SP-----	6-435R		1				Not air transportable.
			2				
FA bn, 8-in. how, towed-----	6-415R	1,778	1	98	63	48	
			2			86	
FA bn, 8-in. how, SP-----	6-435R		1				Not air transportable.
			2				
FA bn, 280-mm gun-----	6-535C	1,678	1	67	43	55	Veh tk recovery not air transportable.
			2			81	
FA rkt bn, 762-mm rkt, SP-----	6-525C	474	1		9	21	Major disassembly of major items is required
			2			30	
FA msl bn, CORPORAL-----	6-545D						Data not available.
FA msl bn, REDSTONE-----	6-635D						
HQ & HQ btry, AAA bde, mbl-----	44-101C	138	1	18	12		
HQ & HQ btry, AAA gp, mbl-----	44-12C	117	1	15	10		
			2		5		
AAA det, op-----	44-7R	65	1	9	6		
			2			4	
AAA bn, AW, mbl-----	44-25C	1,278	1	158	101	1	
			2			65	
AAA bn, AW, SP-----	44-75C	1,485	1	49	32	53	
			2			72	
AAA bn, 75-mm gun, mbl-----	44-35C	1,169	1	64	41	34	
			2			56	
AAA bn, 90-mm gun, mbl-----	44-15C	1,683	1	83	54	49	
			2			90	
Air def arty msl bn, NIKE-AJAX-----	44-145D	2,966	2			170	
Chemical:							
HQ & HQ det, cml gp (fld army)-----	3-32D	40	1	5	4		
			2			3	

See footnotes at end of chart

1	2	3	4	5	6	7	8
Unit	TOE	Total weight unit in short tons	Load method	Aircraft requirements			Remarks
				C-123 C-119	C-130	C-124	
Chemical (contd)							
HQ & HQ det, cml smoke genr bn-----	3-266R	24	1	3	2		
			2			1	
Cml smoke genr co-----	3-267R	316	1	40	26		
			2			16	
HQ & HQ det, cml bn (svc) (army)-----	3-36D	18	1	2	2		
			2			1	
Cml maint co-----	3-47D	108	1	8	6	3	
			2			6	
Cml dep co-----	3-67D	147	1	9	6	4	
			2			8	
Cml co, cmbt spt-----	3-7D	375	1	47	30		
			2			18	
Cml decon co-----	3-217R	156	1	20	13		
			2			9	
Cml tech intel det (IA)-----	3-500R	10	1	1	1		
			2			1	
Cml tech intel det (IB)-----	3-500R	14	1	2	2		
			2			1	
Cml mbl lab det (JA)-----	3-500R	17	1	2	2		
			2			1	
Cml sup team (EA)-----	3-500R	16	1	2			
			2			1	
Cml sup team (EB)-----	3-500R	26	1	1		1	
			2			2	
Cml sup team (EC)-----	3-500R	27	1	1		1	
			2			2	
Cml sup team (ED)-----	3-500R	43	1	3		1	
			2			2	
Cml maint team (FA)-----	3-500R	26	1	1		1	
			2			2	
Cml maint team (FB)-----	3-500R	30	1	1		1	
			2			2	
Cml maint team (FC)-----	3-500R	41	1	2		1	
			2			2	
Cml maint team (FD)-----	3-500R	51	1	4		1	
			2			2	
Engineer: ¹							
HQ & HQ co, engr bde-----	5-301R						Data not available.
HQ & HQ co, engr cmbt gp-----	5-192C	129	1	17	11		
			2			6	
Engr cmbt bn (army)-----	5-35R	1,170	1	97	63	20	
			2			56	
HQ, H & S co, engr cmbt bn, army-----	5-36R	404	1	29	19	9	
			2			21	
Engr cmbt co, army-----	5-37R	253	1	23	15	4	
			2			14	
Engr pnl brg co-----	5-137C	576	1	57	37	6	
			2			29	
Engr float brg co-----	5-138D	1,526	1	101	65	35	
			2			74	
Engr pon brg co-----	5-139R	978	1	98	63	10	
			2			48	
Engr lt eqp co-----	5-367C	1,243	1	47	30	42	
			2			60	

See footnotes at end of chart.

1	2	3	4	5	6	7	8
Unit	TOE	Total weight unit in short tons	Load method	Aircraft requirements			Remarks
				C-123 C-119	C-130	C-124	
Engineer: ¹ (contd)							
Engr topo co, corps.....	5-167C	225	1	16	11	5	
			2			11	
Engr topo bn, army.....	5-55R	515	1	43	28	9	
			2			25	
Engr map repro distr co, army.....	5-57R	242	1	18	12	5	
			2			12	
Engr photomap co, army.....	5-59R	104	1	7	5	3	
			2			6	
HQ, H & S co, engr topo bn, army.....	5-56R	168	1	18	12	1	
			2			9	
HQ & HQ det, engr cam bn.....	5-96R	49	1	7	5		
			2			3	
Engr cam co.....	5-97R	74	1	10	7		
			2			4	
HQ & HQ co, engr cons gp.....	5-312R	79	1	10	7		
			2			4	
Engr cons bn.....	5-315R	2,053	1	104	67	59	
			2			99	
HQ, H & S co, engr cons bn.....	5-316R	956	1	36	23	33	
			2			47	
Engr cons co.....	5-317R	365	1	21	14	10	
			2			18	
Engr dp trk co.....	5-324R	664	1	12	8	28	
			2			33	
Engr hv eqp co.....	5-328R	1,147	1	35	23	42	Not transportable: 2 40-T cranes 2 crush- ing & screening plants 2 60-T lowboys 2 trk, tractor, 15-T.
			2			58	
HQ & HQ co, engr maint & sup gp.....	5-262R	88	1	11	8		
			2			4	
HQ & HQ det, engr dep bn.....	5-266D	40	1	6	4		
			2			2	
Engr dep co.....	5-267D	376	1	16	11	12	
			2			18	
Engr sup pt co.....	5-48R	191	1	6	4	7	
			2			10	
Engr fld maint co.....	5-157C	339	1	24	16	8	
			2			17	
Engr water sup co.....	5-67R	314	1	30	20	4	
			2			15	
Engr parts dep co.....	5-279D	256	1	26	17	3	
			2			13	
Engr fftg teams (FA-FC).....	5-500C	26	1	4	3		
			2			2	
Engr sp eqp maint team (EC).....	5-500C	14	1			1	
			2			1	
Engr tech intel team (IG).....	5-500C	10	1	2	2		
			2			1	
Engr tech intel team (IH).....	5-500C	14	1	2	2		
			2			1	
Engr terrain team (IK).....	5-500C						Data not available.
Engr util team (HG).....	5-500C						Data not available.

See footnotes at end of chart.

1	2	3	4	5	6	7	8
Unit	TOE	Total weight unit in short tons	Load method	Aircraft requirements			Remarks
				C-123 C-119	C-130	C-124	
Engineer: (contd)							
Engr fld maint team (CORPORAL) (EG).	5-500C						Data not available.
Engr fld maint team (AAA) (EF)	5-500C						Data not available.
Engr co, REDSTONE	5-464C						Data not available.
Infantry:							
Inf BG, sep	7-11T	480	1	71	42	4	
			2			33	
Medical:							
HQ & HQ det, med gp	8-22C	30	1	4	3		
			2			2	
HQ & HQ det, med bn (sep)	8-26C	34	1	5	4		
			2			2	
Med coll co (sep)	8-27C	59	1	8	6		
			2			3	
Med clr co (sep)	8-28R	184	1	23	15		
			2			9	
Med holding co	8-57C	77	1	10	7		
			2			4	
Med amb co (sep)	8-317R	164	1	21	14		
			2			8	
Preventive medicine co	8-117R	86	1	11	8		
			2			5	
Med lab	8-650D	73	1	3	2		
			2			4	
Army med dep	8-667R	235	1	27	18		
			2			12	
Army surg hosp, mbl	8-571R	159	1	20	13		
			2			8	
HQ, professional svc (AG)	8-500C	8	1	1	1		
			2			1	
HQ vet svc (AF)	8-500C		1	1	1		
			2			1	
Optical det (GA)	8-500C	11	1				
			2			1	
Optical det, aug (GB)	8-500C	2	1	1	1		
			2			1	
Vet food insp det, small (JA)	8-500C	4	1	1	1		
			2			1	
Surgical det (KA)	8-500C	5	1	1	1		
			2			1	
Orthopedic det (KB)	8-500C	5	1	1	1		
			2			1	
Maxillo-facial det (KD)	8-500C	5	1	1	1		
			2			1	
Shock det (KC)	8-500C	6	1	1	1		
			2			1	
Neurosurgical det (KE)	8-500C	5	1	1	1		
			2			1	
Thoracic det (KF)	8-500C	5	1	1	1		
			2			1	
Prev med con det (LA)	8-500C	29	1	4	3		
			2			2	
Prev med survey det (LB)	8-500C	16	1	2	2		
			2			1	

See footnotes at end of chart.

1	2	3	4	5	6	7	8
Unit	TOE	Total weight unit in short tons	Load method	Aircraft requirements			Remarks
				C-123 C-119	C-130	C-124	
Medical: (contd)							
Gas det (KG).....	8-500C	20	1	3	2		Does not include helicopters.
			2			1	
Dental svc det (KJ).....	8-500C	37	1	2	2		
			2		1	2	
Dental prosthetic det (KK).....	8-500C	9	1			1	
			2			1	
Psychiatric det (KO).....	8-500C	21	1	3	2		
			2			1	
Gen disp (MA).....	8-500C	15	1	2	2		
			2			1	
Med det (OA).....	8-500C	8	1	1	1		
			2			1	
Hel amb unit (RA).....	8-500C	29	1	4	3		
			2			2	
Conv cen, army.....	8-590R	281	1	36	24		
			2			12	
Evac hosp, smbl.....	8-581R	287	1	36	24		
			2			14	
Military Police:							
MP bn, army.....	19-35R	102	1	27	18		Includes requirement for class V.
			2			10	
MP co, corps and army.....	19-37C	70	1	9	6		
			2			4	
HQ & HQ det, MP bn (AD).....	19-500R	22	1	3	2		
			2			2	
MP esc gd co.....	19-47D	106	1	15	10		
			2			6	
MP gd co.....	19-247C	34	1	5	4		
			2			2	
MP det (CI) (ME).....	19-500R	27	1	4	3		
			2			2	
MP det (CI) (MD).....	19-500R	15	1	2	2		
			2			1	
Crime lab, mbl (MG).....	19-500R	13	1	2	2		
			2			1	
Ordnance:							
Ord DS co.....	9-7R	470	1	43	28	10	
			2			29	
Ord hv maint co.....	9-9R	670	1	33	22	22	
			2			34	
HQ & HQ co, ord gp, maint & sup, ammo.	9-12R	91	1	13	9		
			2			5	
Ord ammo co, army.....	9-17	1,133	1	106	68	4	
	(Tent)		2			65	
Ord fld sup co.....	9-57R	912	1	15	10	41	
			2			49	
HQ & HQ det, ord bn.....	9-76R	41	1	7	5		
			2			3	
Ord dir autmv spt co.....	9-127R	523	1	35	23	11	
			2			29	
Ord hv autmv maint co.....	9-197R	583	1	19	13	20	
			2			31	
Ord sp wpn spt bn.....	9-45R	662	1	26	17	30	
			2			45	

See footnotes at end of chart.

1	2	3	4	5	6	7	8
Unit	TOE	Total weight unit in short tons	Load method	Aircraft requirements			Remarks
				C-123 C-119	C-130	C-124	
Ordinance: (contd)							
HQ & HQ det, sp wpn spt bn.....	9-46R	89	1	8	6	1	
			2			6	
Ord sp wpn spt co.....	9-47	593	1	18	12	24	
	(Tent)		2			37	
Ord maint co, amph spt bde.....	9-97R	417	1	29	19	7	
			2			23	
Ord park co.....	9-137	230	1	18	12	2	
			2			13	
Ord recov & clas co.....	9-167R	838	1	19	13	30	
			2			47	
ORD GM DS co (CORPORAL).....	9-228R	485	1	13	9	16	
			2			26	
Ord coll pt co.....	9-358R	266	1	5	4	10	
			2			14	
Ord park co.....	9-359R	155	1	11	8	3	
			2			11	
Quartermaster:							
HQ & HQ det, QM gp.....	10-22R	34	1	5	4		
			2			2	
HQ & HQ det, QM bn.....	10-536R	42	1	6	4		
			2			2	
QM bkry co.....	10-147R	217	1	21	14	2	
			2			11	
QM clo & gen sup dep co.....	10-227R	76	1	10	7		
			2			4	
QM subs dep co.....	10-357C	77	1	10	7		
			2			4	
QM ldry co.....	10-167R	192	1	24	16		
			2			10	
QM refrg co.....	10-247C	491	1	9	6	21	
			2			24	
QM sales co.....	10-157R	172	1	22	15		
			2			9	
QM svc co.....	10-67C	95	1	12	8		
			2			5	
QM petrl sup co.....	10-77R	297	1	35	23	1	
			2			15	
QM bath co (smbl).....	10-257R	71	1	9	6		
			2			4	
QM recov & dspo co.....	10-297R	127	1	16	11		
			2			7	
QM relm & maint co (smbl).....	10-237C	96	1				
			2			5	
QM salv co.....	10-187R	122	1	9	6	2	
			2			6	
QM subs sup co.....	10-197C	110	1	14	9		
			2			6	
Signal: ¹							
Sig bn, corps.....	11-15C	2,306	1	254	163	30	
			2			160	
HQ & HQ co.....	11-16C	182	1	16	11	9	
			2			18	
Rad msg cen op co.....	11-17C	420	1	43	28	4	
			2			22	

See footnotes at end of chart.

1	2	3	4	5	6	7	8
Unit	TOE	Total weight unit in short tons	Load method	Aircraft requirements			Remarks
				C-123 C-119	C-130	C-124	
Signal: ¹ (contd)							
Wire & rad relay op co.....	11-18C	502	1	54	35	4	
			2			31	
Sig cons co.....	11-27C	433	1	47	31	5	
			2			30	
HQ & HQ det, sig gp.....	11-22D	51	1	7	5		
			2			4	
Sig cons bn.....	11-25C	1,981	1	195	125	24	
			2			130	
HQ & HQ det.....	11-26C	147	1	7	5	5	
			2			9	
Sig cons co, sep.....	11-27C	433	1	47	31	5	
			2			30	
Sig op bn.....	11-95R	2,712	1	282	180	28	
			2			160	
HQ & HQ co.....	11-96R	183	1	17	11	3	
			2			11	
Wire op co.....	11-97R	903	1	79	51	13	
			2			51	
Rad op co.....	11-98R	1,212	1	136	87	6	
			2			70	
Msg cen op co.....	11-99R	414	1	50	32	6	
			2			30	
HQ & HQ det, sig spt bn.....	11-116R	69	1	9	6		
			2			4	
Sig spt co.....	11-117R	520	1	65	42		
			2			29	
Sig rep co.....	11-127R	645	1	40	26	14	
			2			32	
Sig dep co.....	11-128C	349	1	29	19	5	
			2			17	
Sig co, amph spt bde.....	11-537R	328	1	39	25	1	
			2			23	
Transportation: ¹							
HQ & HQ co, trans trk gp.....	55-12R	40	1	6	4		
			2			2	
HQ & HQ co, trans trk bn (army).....	55-16R	40	1	5	4		
			2			2	
Trans lt trk co.....	55-17D	487	1	63	41	1	
			2			36	
Trans car co (army).....	55-19C	151	1	32	22		
			2			11	
HQ & HQ det, trans army acft maint bn.....	55-456R	34	1	5	4		
			2			2	
Trans acft DS co.....	55-457	572	1	42	27	16	
			2			32	
Trans acft IS co.....	55-458	684	1	35	22	27	Less 10-ton crane and cargo aircra 1 FW, 1 RW.
			2			40	
HQ & HQ det, trans hel bn (army).....	55-56R	60	1	12	8		
			2			3	
Trans lt hel co.....	55-57C	121	1	12	8	1	Does not include cargo helicopter.
			2			6	

See footnotes at end of chart.

1	2	3	4	5	6	7	8
Unit	TOE	Total weight unit in short tons	Load method	Aircraft requirements			Remarks
				C-123 C-119	C-130	C-124	
Transportation: (contd)							
Cargo hel fld maint (KD).....	55-500R	58	1	5	4	1	
			2			3	
Mov con team.....	55-500R	65	1	9	6		
			2			4	
Intel cmbt (HA).....	55-500R	14	1	3	2		
			2			1	

¹ Unit designations and TOE numbers only are current. Short-ton weights do not reflect recent TOE changes and should be used as a guide only.

(c) *Miscellaneous.*

1	2	3	4	5	6	7	8
Unit	TOE	Total weight unit in short tons	Load method	Aircraft requirements			Remarks
				C-123 C-119	C-130	C-124	
Sp svc co ¹	12-17R	92	1	13	9	2	
			2			8	
MRU (mbl), type Z ¹	12-510R	82	1	2	2	4	
			2			5	
Army postal unit, type O ¹	12-605C	3	1	1	1		
			2			1	
Army postal unit, type R ¹	12-605C	11	1			1	
			2			1	
Army postal unit, type V ¹	12-605C	18	1			2	
			2			2	
BPO, type O ¹	12-520R	12	1	2	2		
			2			1	
BPO, type T ¹	12-520R	43	1	6	4		
			2			3	
BPO, type X ¹	12-520R	99	1	13	9		
			2			5	
Sep band ¹	12-107C	9	1	2	2		
			2			1	
Fin, sec disbursing (AD, FP, GB, HC) ¹	14-500R	6	1	1	1		
			2			1	
HQ & HQ det, repl gp ¹	20-52C	46	1	6	4		
			2			3	
HQ & HQ det, repl bn ¹	20-56C	36	1	5	4		
			2			2	
Rpl co ¹	20-57C	12	1	2	2		
			2			1	
Photo intpr team.....	30-600C	8	1	1	1		
			2			1	
Mil intel svc org.....	30-600C	213	1	27	18		
			2			11	
USASA units.....							See FM 101-10 to part III, (when published).
Loudspeaker & leaflet co, army ¹	33-77R	108	1	11	8	2	
			2			6	
Mil govt gp HQ (AC) ¹	41-500R	82	1	11	8		
			2			4	
Mil govt co HQ (AB) ¹	41-500R	51	1	7	5		
			2			3	
Mil govt plat HQ (AA) ¹	41-500R	12	1	2	2		
			2			1	

¹ Unit designations and TOE numbers only are current. Short-ton weights do not reflect recent TEO changes and should be used as a guide only.

4.13. Movement by Water

a. *General.* Capacities of ships and craft, sea distances, steaming rates, turnaround times, and factors for cargo shipping are contained in chapter 7.

b. *Amphibious Assault.*

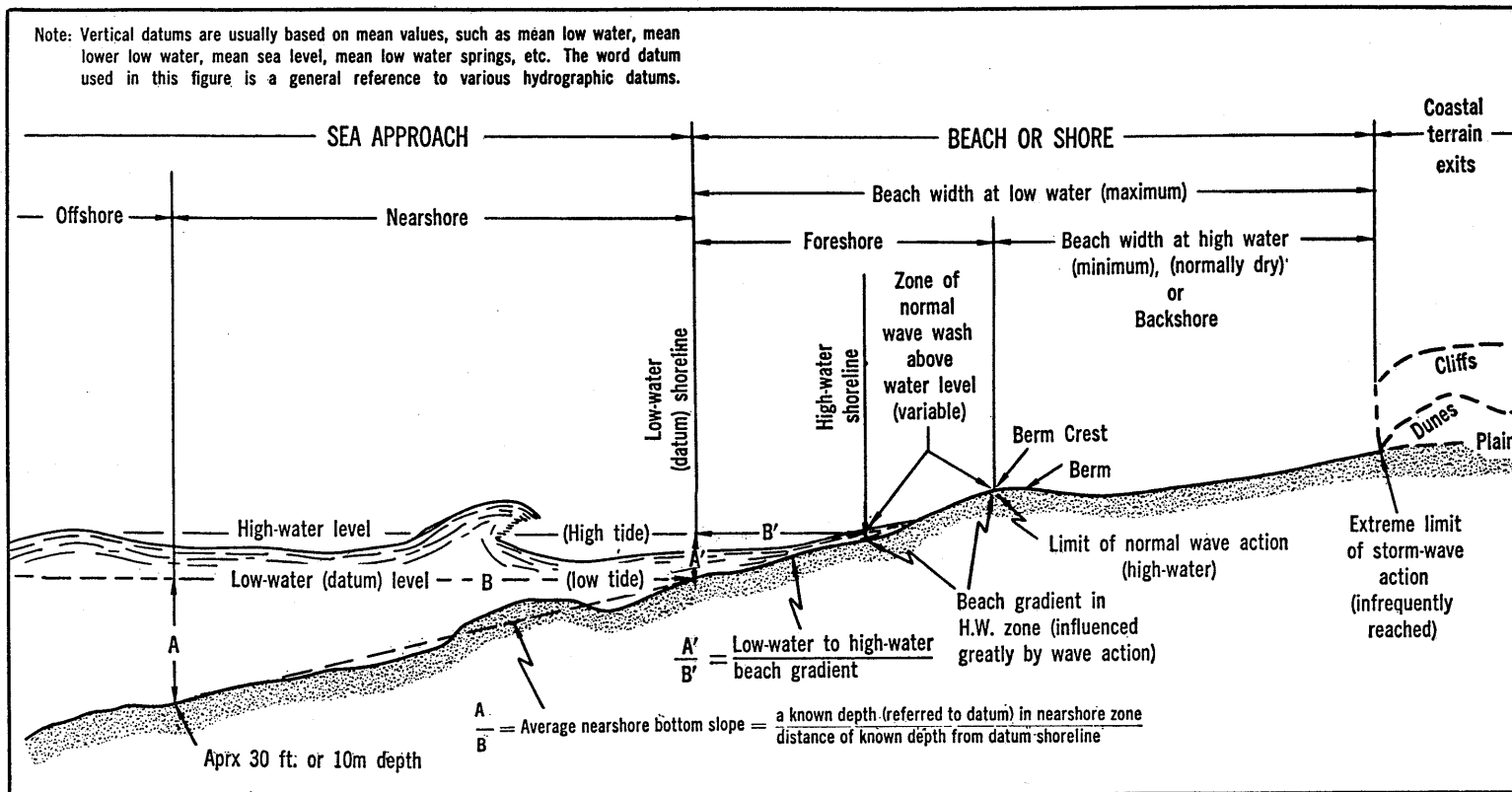
- (1) *Beach analysis and selection.* Strategic considerations aside, the selection of a beach for an assault landing is based upon the potential of the beach and hinterland to permit the initial landing and the followup logistical support of the forces required for the operation until such time as port facilities can be established. From a logistical standpoint, the most important considerations are the characteristics of the beach, beach exits, and hinterland and the forecast weather conditions as they influence the ability of the service forces to support and maintain the forces ashore. Increased use of helicopters and amphibian trac-

tors makes possible the use of less desirable beach areas in the initial assault. Under new concepts of operation and with the employment of special weapons, dispersal of forces and supplies will be necessary; therefore, emphasis will be placed upon the analysis and selection of many small beaches, adequately linked by lines of communication, rather than a few long ones as in the past.

- (2) *Considerations in selecting.* It is of vital importance that before any amphibious operation is undertaken, a detailed investigation and thorough study be made of the hydrography and topography of the target area, as well as of the long-range forecasts of the weather that may be encountered. The factors of primary importance to be considered when selecting beaches for amphibious landings are as follows: (The diagram below depicts certain of the features discussed.)

GENERAL BEACH PROFILE DIAGRAM

(TIDAL SEA)



(a) *Tides.* The stage of the tide and the tidal range are considered as they affect the passage of underwater obstacles, offshore bars, reefs, or shoals, the beaching or stranding of landing craft, and the width of the beach available for operations.

(b) *Surf.*

1. Waves breaking onto a beach may cause landing craft to broach to. This necessitates a study of surf in connection with landing operations. Surf action is dependent on wind, tide, and the depth of water. On flat nearshore bottoms, waves break and are spent before reaching the shoreline. Over steep slopes, the surf breaks near the shore and consequently will have more effect on the beaching of craft. Waves usually break over reefs where they exist, and thus leave the inner area relatively unaffected. Surf conditions can be predicted or forecast hours, and in some cases days, in advance for almost all shores of ocean areas for which regular weather reports are received. Waves created by distant storms may break on a shore with a high or heavy surf, even while local weather conditions are otherwise ideal. Surf forecasts should cover the entire operation and should be available for use as long as any operations across the unprotected beaches are necessary.

2. LVTP-5s can operate satisfactorily in surf up to 8 feet. LCVPs can operate satisfactorily in a surf of 3 or 4 feet, DUKWs in a surf of 3 to 5 feet; in greater surfs, operations should be undertaken only in an emergency. LCM(6)s can operate satisfactorily in a surf up to 6 feet. LCM(8)s can operate satisfactorily in a surf up to 8 feet.

(c) *Near-shore bottom gradient.* Gently sloping bottom gradients cause landing craft to ground at a con-

siderable distance from the shoreline, which increases the hazard and time of unloading. A beach bottom of 1 to 30 is nearly ideal. Steep gradients are difficult in bad weather because of surf conditions and the difficulty of getting cargo away from landing craft.

(d) *Reefs.* In many places, reefs or shoals fringe the shorelines and must be studied prior to beaching operations. A minimum depth of water of 4 feet should be available over reefs or shoals at low tide to permit the low-water operation of landing craft. This is not the normal situation since most reefs are either very close to the surface or entirely exposed at low tide, in which case certain craft must operate at high tide only. A minimum depth of water of 11 feet at low tide is required for the operation of LSTs. Reefs or shoals which limit operations should be avoided in the selection of beach sites.

(e) *Weather.* Predicted weather conditions must be considered in relation to the projected operation. Adverse weather conditions and their effects upon tide and surf may make the operations too hazardous, or impossible. Haze or fog conditions may be advantageous or disadvantageous, depending upon overall considerations of the operation in question. The weather considerations should cover the entire operation and insure favorable conditions for not only the assault landings, but also the followup and buildup phases.

(f) *Topographic.* Having effected a lodgment ashore, the landing forces will be confronted with expanding the beachhead and general movement inland. Here topographic features are of immediate importance. Consideration should be given to overall length of beach; degree of access to the interior from the beach (number of corridors and utility of

each, the existing road net and means of reaching it from the beach); areas suitable for supply dumps (both in the beach area and inland); areas suitable for airstrips, airdrops, helicopter landing sites, and cover and concealment. It is important that each of these factors be analyzed with respect to the advantages or disadvantages that a particular site may offer.

- (g) *Equipment.* Requirements for equipment to approach and unload supplies over the beach must be determined by beach characteristics. If available equipment will not be adequate, early effort must be directed toward the procurement of sufficient amounts of the proper types.
- (h) *Enemy action.* This may take either an active or a passive form. Active enemy action includes the use of existing defense installations, established fields of fire, and employment of the defending forces. Enemy air and naval capabilities also must be considered. Passive enemy action includes obstacles, demolitions, and mines in water adjacent to the beach, on the beach, and immediately inland. All of these will affect the ability of the service troops to furnish the necessary logistical support.
- (i) *Troop availability.* An analysis must be made of troops available for the operation which will include the degree of training, experience, and general suitability of both combat and service elements for the operation under consideration.
- (j) *Time.* The time and place for launching an operation are decided after an analysis of the factors discussed in (a) through (i) above. In addition, the exact time (week, day, and hour) for the assault will be influenced by visibility (as it affects surprise and operations) in the relative number of hours of darkness, moonlight, and daylight. Whether the landing is made in darkness or

daylight is determined largely by the relative effectiveness of the fire and support of the assaulting and defending forces.

(3) *Beach capacity for assault landing.*

- (a) *Size of beaches.* The number of troops which can be landed simultaneously in assault over a given beach is the result of a combination of factors. The tactical formation employed by the assault troops should be the dominant factor, provided safety precautions and good judgment are not sacrificed. In general, the length of beach employed for landing an infantry battle group in assault should conform to the normal frontage assigned for land combat. For the infantry battle group, this normally will be not less than 700 yards nor more than 2,100 yards, an average of 1,500 yards.
- (b) *Time and space factors for landing craft and amphibian tractors.* The interval between landing craft or amphibian tractors landed simultaneously on a beach will vary from 50 yards to 100 yards, an average of 75 yards. The time interval between waves will vary from 1 minute to 15 minutes.
- (c) *Average landing times.* The battle group landing team of approximately 1,700 men requires an average of 50 amphibian tractors or 42 landing craft (LCVP). These are divided into waves, with each successive wave organized to insure a logical tactical buildup on shore. The number of waves varies from 3 to 7, depending upon beach frontage, restricted offshore passages caused by natural and artificial obstacles, the tactical plan ashore, and contemplated enemy resistance. As a rule of thumb, a battle group landing team in assault should be landed on the beach in 30 minutes. A shorter time lapse is desirable when practicable.
- (d) *Followup waves.* Experience indicates that waves of boats landed

subsequently to the assault battle group normally will take longer to unload because they carry more vehicles and supplies. At least a 15-minute time interval should be allowed between these waves. However, the increased time interval between waves is offset by the ability to land boats closer together.

- (e) Assault shipping required for a reinforced infantry division varies according to the tactical mission and the length of the voyage.

1. For long voyages (10 days, for example), primary consideration must be given to provision of the type of shipping that will negotiate the distance at a suitable speed and that will best accommodate the embarked troops. APAs and AKAs meet these requirements better than landing ships. Assault shipping for a reinforced infantry division for an extended voyage, therefore, conforms to the following general pattern:

Type ship	Personnel	Vehicles	No. of ships	Total personnel	Total vehicles
APA-----	1,500	50	10	15,000	500
AKA-----	300	120	2	600	240
LST ¹ -----	200	60	25	5,000	1,500
LSD ¹ -----	200	50	7	1,400	350
CVHA-----	900	0	6	5,400	0
Total-----				27,400	2,590

¹ Number of landing ships varies in proportion to number of amphibian tractors, DUKWs, ground combat vehicles, and LCUs and LCMs to be carried.

2. For short voyages (48-72 hours, for example), accommodation of embarked troops can be subordinated to provision of the most suitable shipping for ease and efficiency in loading and unloading. Landing ships meet these requirements better than APAs and AKAs, especially when ground combat vehicles and amphibian tractors are considered. Assault shipping for a reinforced infantry division for a short voyage, therefore, conforms to the following general pattern:

Type ship	Personnel	Vehicles	No. of ships	Total personnel	Total vehicles
APA-----	1,500	50	1	1,500	50
AKA-----	300	120	2	600	240
LST ¹ -----	300	60	50	15,000	3,000
LSD ¹ -----	300	50	7	2,100	350
CVHA-----	900	0	6	5,400	0
Total-----				24,600	3,640

¹ Number of landing ships varies in proportion to number of amphibian tractors, DUKWs, ground combat vehicles, and LCUs and LCMs to be carried.

3. It will be noted, in comparing the patterns of assault shipping for extended and short voyages, that although the personnel lift remains approximately equal, the number of vehicles lifted in the assault shipping for a short voyage greatly exceeds the number lifted in the assault shipping for a long voyage. This is because the landing ships carry a balanced personnel and vehicle load as compared with APAs, which carry large numbers of personnel but few vehicles. The increased use of LVTs and helicopters in the ship-to-shore movement will generally increase the use of LST, LSD, and CVHA type ships in the amphibious assault, with a resultant decrease in the numbers of APA type ships.

4. Available shipping will always affect the composition of assault shipping. Efficient loading and allowable overloads likewise affect the number of personnel and vehicles that can be loaded. For example, it was common in both Europe and the Pacific to load 500 troops on LSTs.

- (f) *Vehicles and supply.* Vehicles and supply carried by the assault and early followup waves may be substituted for men, as given in the above tables, on the basis of space or weight, whichever is the determining factor in each case. The boat space occupied by 1 man and his individual equipment normally is considered to be 224 pounds, 13.5 cubic feet or 3 square feet.

c. River Crossing.

- (1) *Bridges.* In an assault on a river line, the number of bridges provided for each tactical unit will vary widely, depending upon many factors. Some of these are width of river, stream velocity, the available road net, trafficability of the soil, the types and amounts of equipment available, and the number of available engineer troops. As a rule, at least one floating bridge to take division loads will be necessary within the zone of each assault division. These bridges normally will be supplemented by 1 additional bridge per corps zone and at least 1 in the army zone. Communications zone troops ordinarily will provide

a railroad bridge in the zone of each army.

- (2) *Ferries.* In addition to the factors discussed above, the numbers and types of ferries used will be affected by the number of bridges planned and by the extent to which landing craft and amphibious vehicles are employed. For narrow streams, it frequently will be more economical to construct a bridge at each available site than to use ferries. On the other hand, in crossing a wide river when the construction of bridges will be delayed, ferries of all types will be used to the greatest degree possible.
- (3) Detailed characteristics of bridging and ferrying equipment are shown in paragraphs 4.28 and 4.29.

Section III. TRAINING

4.14. Maneuver Area

a. Divisional weapons, particularly the 90-mm and 120-mm tank guns, have outmoded the criteria applicable for World War II training ranges. The 90-mm tank gun should be allowed a minimum of 22,300 meters (22.3 kilometers)¹ to permit fully realistic training in combat fire.

The 120-mm gun requires a firing range of 32,000 meters (32.0 kilometers). Consequently, installations which have previously been utilized for training of divisions are no longer capable of meeting fully the present-day requirements.

b. Data on installation areas in approximate acreages are as follows:

Type units	Approximate number troops	Cantonment area	Miscellaneous activities area	Field exercise area	Firing and impact area	Total
Inf div.....	¹ 30,000	2,200	1,000	50,000	90,000	143,200
Armd div.....	¹ 30,000	2,200	1,000	70,000	140,000	213,200
Abn div.....	¹ 30,000	2,200	1,000	50,000	² 90,000	143,200
Corps troops.....	³ 30,000	2,400	1,000	10,000	40,000	53,400
Air defense firing center.....	⁴ 2,500	⁴ 250	⁴ 150	⁵ 6,000	⁵ 70,000	76,400
Tank firing center.....	⁶ 2,500	⁶ 250	⁶ 150	Not required.	140,000	140,400

¹ Includes divisional, nondivisional, and supporting troops (aggregate strength).

² Consideration must be given to cleared areas for drop zone and assault transport landing areas. An airdrome capable of taking large transports should be nearby. An airborne division maneuver area should contain an airfield, capable of handling large airplanes, immediately adjacent to the cantonment area. One or more large drop and assault transport landing zones should be located near the cantonment area, and the others scattered throughout the maneuver area. At least one such zone should be located adjacent to the firing and impact area to permit conduct of small unit problems using live ammunition.

³ Normal assignment of corps troops plus one-third of normal army engineer and army air defense units.

⁴ Per group of 2 AW battalions and 1 gun battalion.

⁵ Provides position areas and danger areas for simultaneous firing of the 3 gun battalions through 45° safety angle. Danger area may be sited over water.

⁶ Per 3 tank battalions and proportionate station overhead.

¹ Range is approximate. See AR 385-63 for specific requirements.

4.15. Training Facilities for Infantry, Airborne, and Armored Divisions

a. The cantonment area should be located near the perimeter of the land available, accessible to highways and railroad facilities. The area should provide all housing, storage, railroad yards, administration, shops, close-in training areas, miscellaneous training courses, and recreational facilities. For a functional layout of division-type camps, see OCE drawing number E-16-06-21 and E-16-06-22 obtainable from Office, Chief of Engineers.

b. The miscellaneous activities area includes the station hospital, airfields, divisional review field, and other administrative activities not included in the cantonment area.

c. The field exercise area includes all available land except that used for cantonment, miscellaneous activities, and firing and impact area. Portions of the firing and impact area not in use when the exercises are conducted may be utilized as field exercise area. It is desirable that this area contain streams or lakes for training in construction of fixed and floating bridges. Landing strips for organic aircraft should be located at several places in the field exercise area. The area for an airborne division should contain several cleared areas suitable for use as drop and landing zones.

d. Firing and impact area permits the firing of all ranges simultaneously, except, in some cases, those whose impact areas are superimposed. For suggested layout, see SR 210-20-20. For safety requirements, see AR 385-63. This

area should be of varied terrain with suitable locations for ground observation points. The impact area may be submarginal or swamp land.

e. The division review field should be an area at least 240 by 1,500 yards, adjacent to or near the cantonment area.

f. Drill fields should be located in close proximity to each battle group or other major unit area.

g. The landing field should be available in the vicinity of the cantonment area for use by organic aircraft.

h. Four airfields capable of meeting minimum standards under favorable weather conditions for current and planned assault transport aircraft should be provided in the field exercise area for training in air-landed operations.

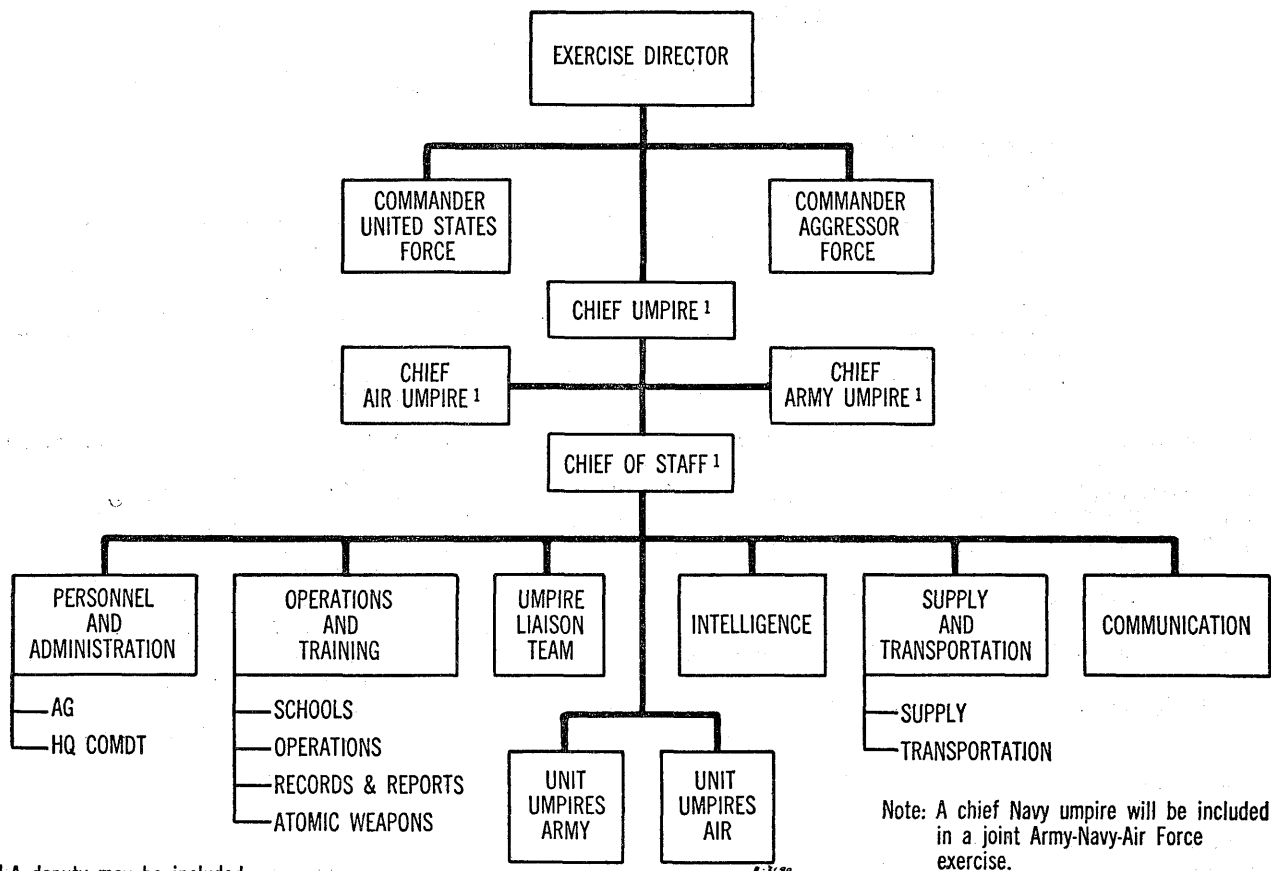
i. An airfield suitable for use by large numbers of transport aircraft should be on or near the installation. It is desirable to have other airfields, suitable for use by Air Force aircraft, within 1 day's march of an airborne division installation.

j. The close-in training area, in order to permit the maximum use, should be located in close proximity to the housing area.

k. Ranges for the infantry, airborne, and armored division posts may be found listed in SR 210-20-20, together with the number of ranges, positions, lanes, bays, or firing points required for each type of unit, also the drawing number from which they may be constructed and the appropriate training manual reference.

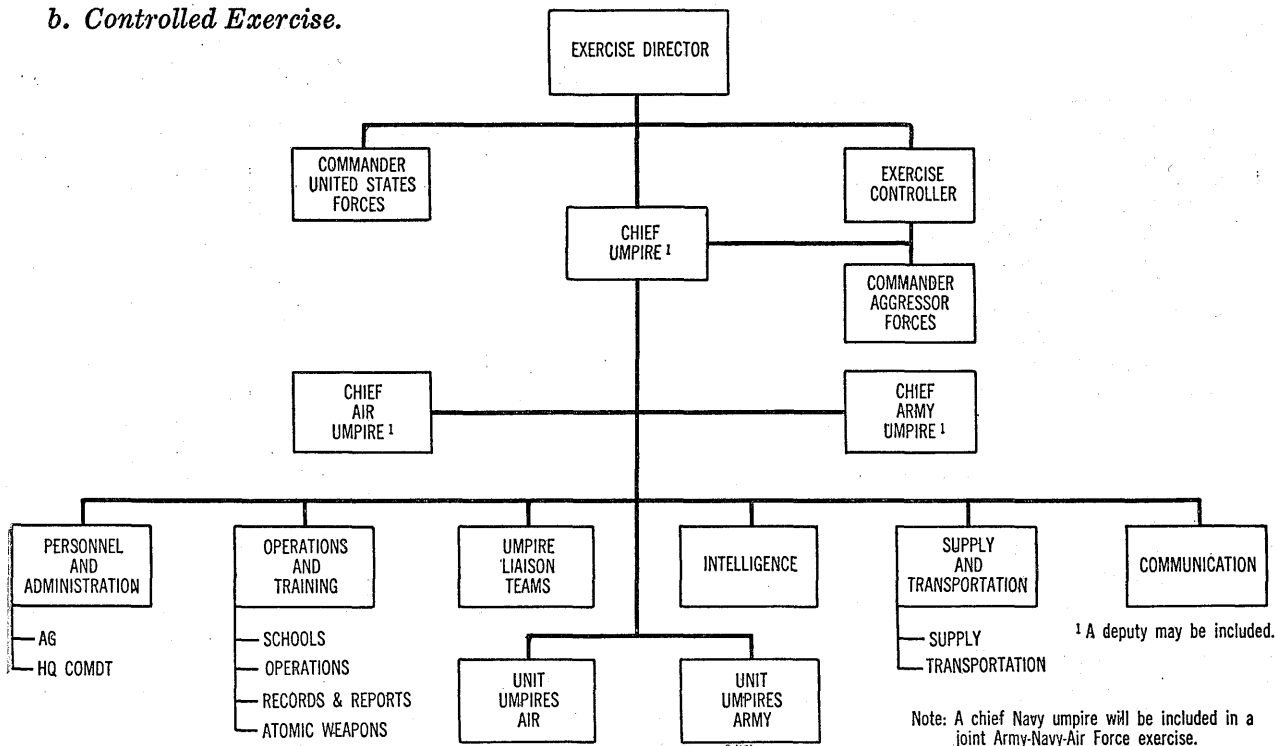
4.16. Umpire Organization

a. Free Exercise.



¹ A deputy may be included.

b. Controlled Exercise.



4.17. Umpire Requirements

For umpire requirements, see FM 105-5.

Section IV. TACTICAL OPERATIONS

4.18. Characteristics of Weapons

a. Vehicular Weapons, Combat Vehicles (Less Artillery).

	1	2	3	4	5
	Vehicle	Primary weapon	Sustained rate of fire	Effective range (meters)	Area of burst (HE)
2	Gun, SP, HT, M16A1, M16A2-----	MG cal. .50 M2(4)	1,800	6,500 (Hor)	
3	Gun, SP, FT, twin 40-mm, M42A1, M2, M19A1.	Gun, dual auto-----	120	5,050	
4	Mortar, SP, HT, 81-mm, M21-----	Mortar, 81-mm-----	18	2,400 3,000	15—18 meters radius
5	Mortar, SP, FT, 4.2-in., M84-----	Mortar, 4.2-in., M30-----	¹ 5	5,350	41 x 14 meters
6	Gun, SP, FT, 90-mm, M56 (abn)-----	Gun, 90-mm, M54-----	²	²	²
7	Tank, combat, FT, 76-mm gun, M41 and M41A1.	Gun, 76-mm, M32-----	1	1,850 AP 13,700 HE	30 x 5 meters
8	Tank, combat, FT, 90-mm gun, M47-----	Gun, 90-mm, M36-----	1	1,850 AP 17,350 HE	37 x 11 meters
9	Tank, combat, FT, 90-mm gun, M48-----	Gun, 90-mm, M41-----	1	1,850 AP 17,350 HE	37 x 11 meters
10	Tank, combat, FT, 120-mm gun, M103-----	Gun, 120-mm, M58-----	1	1,850 AP 26,950 HE	46 x 8 meters

¹ First 20 min.

² Will be furnished when available.

b. Infantry Weapons.

	1	2	3	4	5	6
	Weapon	Maximum rate of fire (rounds per min)	Sustained rate of fire (rounds per min)	Maximum range (meters)	Maximum effective range (meters)	Effective radius of burst (meters)
2	Carbine, cal. .30, M2-----	750-775	40-60	2,000	252	-----
3	Grenade, hand, frag, M26A1-----			32-37	32-37	-----
4	Grenade, hand, offensive, MKIII A2-----			32-37	32-37	-----
5	Grenade, rifle, HEAT, M31-----					-----
6	Flamethrower, portable, M2A1-----		6-9 sec			-----
	Unthickened fuel-----				18	-----
	Thickened fuel-----			50-59	41	-----
7	Flamethrower, portable, M2A1-7-----		6-9 sec			-----
	Unthickened fuel-----				18	-----
	Thickened fuel-----				48	-----
8	Gun, machine, cal. .30, Bng, M1917A1-----	450-600	125	3,200		-----
	Antiaircraft-----				640	-----
	Ground-----				1,850	-----
9	Gun, machine, cal. .30, Bng, M1919A6-----	600-650	75	3,200		-----
	Antiaircraft-----				640	-----
	Ground-----				1,850	-----
10	Gun, machine, cal. .30, Bng, M1919A4, flexible-----	400-550	75	3,200		-----
	Antiaircraft-----				640	-----
	Ground-----				1,850	-----
11	Gun, machine, cal. .50, Bng, M2, HB, flexible-----	400-600	40	6,764		-----
	Antiaircraft-----				914	-----
	Ground-----				1,828	-----

	1	2	3	4	5	6
1	Weapon	Maximum rate of fire (rounds per min)	Sustained rate of fire (rounds per min)	Maximum range(meters)	Maximum effective range(meters)	Effective radius of burst (meters)
12	Mortar, 81-mm, M1 and M29 with mount, M23A1 or M23A3	30-35	18			
	Cartridge, HE, M43A1			3,007	3,007	23 x 14
	Cartridge, HE, M362			3,839	3,839	27 x 18
	Cartridge, SMK, WP, M57A1			2,243	2,243	16
	Cartridge, illum, M301A2			2,239	2,239	0
13	Mortar, 105-mm, T33E4, T58					
	Cartridge, 105-mm, HE, T53E1			5,484	5,484	
14	Pistol, automatic, cal. .45, M1911A1	21-28	10	1,500	46	
15	Rifle, automatic, Browning, cal. .30 M1918A2	350-550	40-60	3,200	457	
16	Rifle, cal. .30, M1	16-32	16	3,200	457	
17	Rifle, cal. .30, M1C and M1D	10-15	10	3,200	721-914	
18	Rifle, 57-mm, M18A1	11	1.6			
	Cartridge, HEAT, M307A1			3,975	1,097	
19	Rifle, 106-mm, M40A1	11	1.6	7,678	1,828	N/A
	Cartridge, HEAT, 106-mm, M344			6,183	¹ 1,005	
	Cartridge, HEP-T, 106-mm, M346			6,869	¹ 1,005	
20	Launcher, rocket, 3.5-in., M20, M20A1, M20A1B1, M20B1	8	4	823		18 x 9
	Area targets				823	
	Point targets				366	
21	Gun, submachine, cal. .45, M3A1	450	40-60	1,609	91	

¹ Limit imposed by spotting rifle range.

c. Artillery Weapons.

(1) Field artillery.

	1	2	3	4	5	6	7	8
1	Type, caliber, and carriage model	Time to emplace (min)	Maximum rate of fire (rounds per min) ¹	Projectiles (HE unless otherwise indicated)				
				Effective area of burst (meters) ²		Weight (lb)	Maximum range (meters)	
				Lateral	Range		100 percent	85 percent
2	76-mm gun, M1A2 (motor carriage, M18)		20	27	9	³ 15	12,979	11,032
3	76-mm gun, M48, and 76-mm gun (carriage, M29)	2	12	27	9	15.4	12,979	11,032
4	105-mm howitzer, M2A1 and M2A2 (carriage, M2A2)	3	4	27	18	33	11,290	9,565
5	105-mm howitzer, M4 and M4A1 (motor carriage, M37)	1	4	27	18	33	11,290	9,565
6	105-mm howitzer, SP, M49 (T96E1); 105-mm howitzer, SP, FT, M52 (T98E1)	1	4	27	18	33	11,290	9,565
7	Mortar, 4.2-in., M30	1 to 3	15-20	45	13	24.5	5,664	4,815
8	4.5-in. multiple rocket launcher, M21	5	25	46	14	37.5	8,230	6,996
9	155-mm howitzer, M1 and M1A1 (carriage, M1A2)	5	3	45	27	95	14,939	12,706
10	155-mm howitzer, M1 and M1A1 (motor carriage, M41)	1	3	45	27	95	14,939	12,706
11	155-mm howitzer, SP, M45 (T186E1); 155-mm howitzer, SP, FT, M44 (T194)	1	3	45	27	95	14,939	12,706
12	155-mm gun, M2 and M2A1 (carriage, M1)	$\frac{1}{2}$ to 6 hr	2	45	27	95	23,504	19,977
13	155-mm gun, M2 and M2A1 (motor carriage, M40)	1	2	45	27	95	23,504	19,977

	1	2	3	4	5	6	7	8
	Type, caliber, and carriage model	Time to emplace (min)	Maximum rate of fire (rounds per min) ¹	Projectiles (HE unless otherwise indicated)				
				Effective area of burst (meters) ²		Weight (lb)	Maximum range (meters)	
				Lateral	Range		100 percent	85 percent
14	155-mm gun, M46 (T80); 155-mm gun, SP, M53 (T97)-----	1	2	45	27	95	23,504	19,977
15	8-in. howitzer, M2 (carriage, M1)-----	½ to 6 hr	1	73	27	200	16,918	14,380
16	8-in. howitzer, M2 (motor carriage, M43)-----	1	1½	73	27	200	16,918	14,380
17	8-in. howitzer, M47 (T89); 8-in. howitzer, SP, FT, M55 (T108)-----		1½	73	27	200	16,918	14,380
18	280-mm gun, T131 (carriage, T72) ⁵ ----	12	½	55	59	600	28,517	24,239
19	FA rkt bn, 762-mm, SP ⁵ -----	25	2 rd/ lchr/hr			5,800	⁴ 12,705	⁴ 10,799
20	FA msl bn, CORPORAL ⁵ -----						26,110	23,200
21	FA msl bn, REDSTONE ⁵ -----							
22	FA msl bn, LA CROSSE ⁵ -----							

¹ Not applicable for sustained fire.

² Burst radius varies with the type of fuze fired, range fired, type of impact area, and weather.

³ Armor-piercing projectile.

⁴ Using minimum powder charge.

⁵ See FM 101-10, part III (when published).

(2) Air defense artillery (including automatic weapons).

(a) General.

	1	2	3	4	5	6	7
	Type, model, and carriage model	Time to emplace (min)	Maximum rate of fire (rounds per min)	Range (meters)			
				Horizontal		Vertical	
				Maxi- mum	Fuse limit	Maxi- mum	Fuse limit
2	Motor carriage, M16, with multiple (4) cal. .50 machinegun mount, M45.		1,800	6,500		16,398	
3	Trailer, multiple (4) cal. .50 machinegun mount, M55-----	² 3-----	1,800	6,500		16,398	
4	40-mm automatic gun, M1, on carriage, M2A1, AA-----	3-5-----	³ 120	45,050	55,050	5,050	55,050
5	Motor carriage, 40-mm, M19, with twin mount, M4-----		³ 240	45,050	55,050	5,050	55,050
6	SP, twin 40-mm gun, M42-----		240	45,050	55,050	5,050	55,050
7	75-mm gun, AA weapon system, M51, towed, w/cannon; 75-mm gun, M35.	30-----	45	13,700	66,581	6,398	65,667
8	90-mm gun, M2, AA, on mount, M2, AA-----	20-----	25	18,262	711,357	12,037	710,625
9	120-mm gun, M1, AA on mount, M1A1, AA-----	60-----	10	25,821	14,990	18,828	715,081
10	NIKE-AJAX system-----	8 hr-----	1	45,700		18,280	

¹Maximum practical vertical range, limited by length of burning of tracer (1645 meters).

²May be fired from traveling position.

³Manual (single shot)—60 rounds per gun per minute.

⁴For tactical planning—1,828 meters.

⁵12-second fuse limit.

⁶15-second fuse limit.

⁷30-second fuse limit.

(b) *Ranges of automatic weapons.*

1	2	3	4	5	6	7	8	9
Maximum deterrent slant range (meters) ¹			Maximum killing slant range (meters) ¹			Effective killing slant range (meters) ¹		
40-mm director control	40-mm M7 sight control	.50 cal. MG ²	40-mm director control	40-mm M7 sight control	.50 cal. MG	40-mm director control ³	40-mm M7 sight control	.50 cal. MG
3,200	3,200	1,645	2,285	1,370	840	⁴ 1,370-370	⁴ 920-370	460-0

¹ Slant range is distance from weapon to target.

² Tracer burnout range. The extent of deterrent effect of .50-caliber tracer is questionable.

³ Average hit expectancy, or number of hits expected, per 100 rounds fired is 4 percent.

⁴ Minimum range limited by maximum tracking rate. For targets diving directly at the gun, minimum range would be unlimited.

(3) *Field artillery barrages and concentrations.*

(a) *Barrages.* A barrage is a special type of prearranged fire placed on a

line. The data contained in the following table are approximate and will vary for different charges and terrain.

1	2	3	4			5			
			Width of battery barrages (meters)			Permissible number of rounds per piece			
			Size of battery			1st ½ min	1st 4 min	1st 10 min	Prolonged fire (rounds per hr)
Caliber and type	Area effectively covered by one projectile ¹ (width x depth) (meters)	Radius of large fragments (meters)	2 piece	4 piece	6 piece				
105-mm howitzer.....	27 x 18	174	-----	-----	192	2	16	40	120
155-mm howitzer.....	45 x 27	257	-----	-----	310	2	8	30	60
155-mm gun.....	45 x 27	257	-----	² 223	-----	2	8	10	30
8-in. howitzer.....	73 x 27	475	-----	² 347	-----	-----	4	10	30
280-mm gun, T131.....	55 x 59	675	205	-----	-----	-----	2	5	20
4.2-in. mortar.....	45 x 13	170	-----	-----	421	10	30	50	60

¹ The area covered effectively is considered to be that area in which there is at least 50 percent chance that a man standing will become a casualty. The area is roughly elliptical.

² Not suitable for firing close to friendly troops. May be used to add depth to barrage.

(b) *Concentrations.* A concentration is a volume of fire placed on an area within a limited time.

1	2	3	4	5	6
Area and ammunition	Unit				Remarks
	4.2-in. mortar bn	105-mm how bn	155-mm how bn	8-in. how bn	
	6-piece btry	6-piece btry	6-piece btry	4-piece btry	
Approximate size of area covered (meters). ¹	366 x 267	219 x 160	348 x 210	338 x 137	Firing with open sheaf.
Amount of ammunition to cover (rounds).....	-----	72	72	60	

¹ The area covered effectively is considered to be that in which there is at least 50 percent chance that a man standing will become a casualty. The area is roughly elliptical.

4.19. Characteristics of Chemical Weapons, Agents, and Munitions

a. Characteristics of Chemical Weapons.

	1	2		3	4	5	6	7	
1	Weapon	Weight		Transportation	Fuel tank capacity (gal)	Fuel consumption rate	Duration of continuous fire (sec)	Maximum effective range	
		Empty (lb)	Filled (lb)					Liquid fuel (yd)	Thickened fuel (yd)
2	Flamethrower, portable, M2A1.	43	72	Man carried	4¾	½ to ¾ gal/sec	6 to 9	20	45
3	Flamethrower, portable, M2A1-7.	41	70	Man carried	4½—4¾	½ to ¾ gal/sec	6 to 9	20	53
4	Irritant gas disperser, skid-mounted, GED, 5,000 cFM, M2.	550	590	¾-ton truck	40 lb	13 lb/min	180		
5	Generator, smoke, mechanical, M2A1.	180	266	¼-ton truck and trailer.			Continuous	Not applicable.	Not applicable.
	Fog oil				(*)	50 gal/hr			
	Water				6	5 gal/hr			
	Gasoline				6	5 gal/hr			
6	Generator, smoke, mechanical, pulse-jet, M3A1.	137	156	¼-ton truck and trailer.			Continuous	Not applicable.	Not applicable.
	Fog oil				(*)	25-50 gal/hr			
	Gasoline				3½	3 gal/hr			
7	Generator, smoke, mechanical, pulse-jet, M3A2.	173	190	¼-ton truck and trailer.			Continuous	Not applicable.	Not applicable.
	Fog oil				(*)	25-50 gal/hr			
	Gasoline				3½	3 gal/hr.			

* No tank; fog oil used from 5-gallon or 55-gallon drum.

b. Characteristics of Chemical Agents.

(1) Toxic war gases. See FM 3-8.

(2) Screening smokes.

1	2	3	4	5	6	7
Name	Symbol	Making	Odor	Status ¹	Tactical classification	Possible method of dispersion
2 White phosphorus ²	WP	1 yellow band WP SMOKE.	Burning matches.	S	Screening smoke....	Bomb, artillery, mortar, grenade, rocket.
3 Plasticized white phosphorus. ²	PWP	1 yellow band PWP SMOKE.	Burning matches.	S	Screening smoke....	Bomb, artillery, mortar, grenade, rocket.
4 Sulfur trioxide solution ³	FS	1 yellow band FS SMOKE.	Acrid	S	Screening smoke....	Artillery, mortar, spray.
5 Hexchloroethane mixture.	HC	1 yellow band HC SMOKE.	Acrid; like camphor.	S	Screening smoke....	Bomb, artillery, mortar, grenade, pot.
6 Fog oil ⁴	SGF1 SGF2	SGF OIL.....	Like petroleum oil.	S	Screening smoke....	Mechanical smoke generator, pot.

¹ S-standard; SS-substitute standard; LS-limited standard

² WP and PWP have secondary classification as incendiary and antipersonnel agent; solid particles burn the skin.

³ Liquid FS and FM are corrosive to the skin; smoke irritates the skin.

⁴ Fog oil, in two grades—SGF1 and FSG2, is issued by the Quartermaster Corps.

(3) Signaling smokes.

	1	2	3	4	5	6	7
1	Name	Symbol	Making	Odor	Status ¹	Tactical classification	Possible method of dispersion
2	Green smoke.....	GS	1 yellow band, color indicated.	Acrid.....	S	Signaling.....	Artillery, grenades.
3	Red smoke.....	RS	1 yellow band, color indicated.	Acrid.....	S	Signaling.....	Artillery, grenades.
4	Violet smoke.....	VS	1 yellow band, color indicated.	Acrid.....	S	Signaling.....	Artillery, grenades.
5	Yellow smoke.....	YS	1 yellow band, color indicated.	Acrid.....	S	Signaling.....	Artillery, grenades.

¹ S-standard; SS-substitute standard; LS-limited standard.

(4) Incendiary agents.

	1	2	3	4	5	6	7
1	Name	Symbol	Making	Odor	Status ¹	Tactical classification	Possible method of dispersion
2	Incendiary mixture, PT1. ²	PT1	1 purple band PT1 INCEND.	Like petroleum oil.	S	Incendiary.....	Bomb.
3	Incendiary oil, IM ³	IM	1 purple band IM INCEND.	Like gasoline....	S	Incendiary.....	Bomb.
4	Incendiary oil, NP ⁴	NP	1 purple band NP INCEND.	Like petroleum oil.	S	Incendiary.....	Bomb; flamethrower.
5	Incendiary oil, NP2 ⁵	NP2	1 purple band NP2 INCEND.	Like petroleum oil.	SS	Incendiary.....	Bomb.
6	Incendiary oil, NP3 ⁶	NP3	1 purple band.....	Like kerosene..	S	Incendiary.....	Fire starter.
7	Thermate, TH3.....	TH3	1 purple band TH3 INCEND.	None.....	S	Incendiary.....	Bomb, grenade.
8	Thermate, TH2.....	TH2	1 purple band TH2 INCEND.	None.....	LS	Incendiary.....	Bomb, grenade.
9	Thermite, TH1.....	TH1	1 purple band TH1 INCEND.	None.....	S	Incendiary.....	Cryptographic equipment destroyers.

¹ S-standard; SS-substitute standard; LS-limited standard.

² Mixture of magnesium and petroleum products.

³ Thickened gasoline.

⁴ Gasoline thickened with thickener, incendiary oil, M1 (napalm).

⁵ Gasoline thickened with thickener, incendiary oil, M2 (antiagglomerated napalm).

⁶ Kerosene thickened with thickener, incendiary oil, M1 (napalm).

c. Data on Chemical-Filled Munitions.

	1	2	3	4	5	6
1	Munition	Agent and weight of filling (lb unless otherwise indicated)	Weight of filled projectile (lb unless otherwise indicated)	Approximate time for agent to burn or evaporate at point of release ²	Marking and color	Chemical efficiency (percentage) ³
	<i>Grenade</i>					
2	Grenade, hand, irritant, CN-DM, M6.	CN-DM..... 0.64	1.06	Aprx 1 min....	CN-DM gas, 1 red band.....	61
3	Grenade, hand, irritant, CN-DM, M6A1.	CN-DM..... 0.66			CN-DM gas, 1 red band.....	
4	Grenade, hand, tear, CN, M7A1.	CN..... 0.79	1.16	Aprx 1 min....	CN gas, 1 red band.....	68

See footnotes at end of table.

1	2	3	4	5	6
Munition	Agent and weight of filling (lb unless otherwise indicated)	Weight of filled projectile (lb unless otherwise indicated)	Approximate time for agent to burn or evaporate at point of release ²	Marking and color	Chemical efficiency (percentage) ³
5 Grenade, hand, tear, CN M7----	CN----- 0.64	1.06	Aprx 1 min---	CN gas, 1 red band-----	61
6 Grenade, smoke, white, HC, AN-M8.	HC----- 1.2	1.6	2 to 3 min---	HC smoke, 1 yellow band-----	75
7 Grenade, incendiary, TH3, AN-M14.	TH3----- 1.65	2	30 to 45 sec---	TH incend, 1 purple band-----	82
8 Grenade, hand, smoke, WP, M15.	WP----- 0.95	1.93	Aprx 1 min---	WP smoke, 1 yellow band-----	47
9 Grenade, smoke, colored, M18 (4 colors). ¹	Color----- 0.72	1.2	Aprx 1 min---	1 yellow band; lettering and color of top indicate color of smoke.	60
10 Grenade, hand, riot, CN, M25-A1.	CN----- 0.2	.47	Immediately--	1 red band on container; none on grenade.	42
11 Grenade, rifle, smoke, WP, M19A1.	WP----- 0.5	1.5	Aprx 1 min---	WP smoke, 1 yellow band-----	33
12 Grenade, rifle, smoke, M22 (4 colors). ¹	Color----- 0.4	1.3	Aprx 1 min---	1 yellow band (colors indicated).	30
13 Grenade, rifle, smoke, colored streamer, M23 (4 colors). ¹	Color----- 0.4	.9	Aprx 12 sec minimum.	1 yellow band (colors indicated).	44
<i>Incendiaries</i>					
14 Cryptographic equipment destroyer, incendiary, TH1, M-2A1.	TH1-8.5-----	11.5	Aprx 1 min---	TH1, 1 purple band-----	74
15 Cryptographic equipment destroyer, incendiary, TH1, M1A1.	TH1-28-----	32	Aprx 1 min---	TH1, 1 purple band-----	88
16 Cryptographic equipment destroyer, incendiary, TH1, M1A2.	TH1-28-----	32	Aprx 1 min---	TH1, 1 purple band-----	88
17 Document destroyer, emergency, incendiary, M3.	Sodium nitrate-95.	-----	20 sec-----	1 purple band on container; none on file destroyer.	-----
18 File destroyer, incendiary, M4---	Sodium nitrate-73.	-----	30 min-----	1 purple band on container; none on file destroyer.	-----
<i>Landmine</i>					
19 Mine, chemical, 1 gallon-----	HD-9.9-----	12	Aprx 15 sec---	HD gas, 2 green bands-----	83
<i>Smoke pot</i>					
20 Pot, smoke, HC, M41-----	HC-10.25-----	12	5 to 8 min---	HC smoke, 1 yellow band-----	84
21 Pot, smoke, floating HC, M4A2	HC-27-----	38	10 to 15 min---	HC smoke, 1 yellow band-----	71
22 Pot, smoke, HC, 30-lb, M5-----	HC-27-----	33	10 to 20 min---	HC smoke, 1 yellow band-----	81
23 Pot, smoke, floating, SGF2, AN-M7.	Fog oil-13.0----	37	12 to 17 min---	1 yellow band-----	32
<i>3.5-inch rocket</i>					
24 Rocket, smoke, 3.5-in., WP, M30.	WP-2.3-----	8.9	Immediately--	WP smoke, 1 yellow band-----	-----

See footnotes at end of table.

	1	2	3	4	5	6
1	Munition	Agent and weight of filling (lb unless otherwise indicated)	Weight of filled projectile (lb unless otherwise indicated)	Approximate time for agent to burn or evaporate at point of release ²	Marking and color	Chemical efficiency (percentage) ²
	<i>57-mm rifle</i>					
25	Cartridge, 57-mm, smoke, WP, M308A1.	WP—0.3-----	2.75	Immediately--	WP smoke, 1 yellow band----	13
	<i>60-mm mortar</i>					
26	Cartridge, 60-mm smoke, WP, M3021.	WP—0.75-----	4	Aprx 1 min---	WP smoke, 1 yellow band----	18
	<i>75-mm rifle</i>					
27	Cartridge, 75-mm, smoke, WP, M311A1.	WP—1.35-----	16.1	Immediately--	WP smoke, 1 yellow band----	8
	<i>76-mm gun</i>					
28	Cartridge, 76-mm, smoke, WP, M312.	-----	-----	-----	-----	-----
29	Cartridge, 76-mm, smoke, WP, M361.	WP—0.73-----	12.95	Immediately--	WP smoke, 1 yellow band----	5
	<i>81-mm mortar</i>					
30	Cartridge, 81-mm, smoke, WP, M57A1.	WP—4.06-----	12.3	Aprx 1 min---	WP smoke, 1 yellow band----	33
31	Cartridge, 81-mm, smoke, FS, M57A1.	FS—4.59-----	12.18	Aprx 1 min---	FS smoke, 1 yellow band----	37
	<i>90-mm gun</i>					
32	Cartridge, 90-mm smoke, WP, M313.	WP—1.97-----	23.64	Immediately--	WP smoke, 1 yellow band----	8
	<i>105-mm howitzer</i>					
33	Cartridge, 105-mm, smoke, BE, M84.	HC—4.96----- Green—2.71-----	32.86 30.48	2-5 min----- Aprx 1 min---	HC smoke, 1 yellow band---- 1 yellow band (colors indicated).	15 9
		Violet—2.91----- Red—2.91----- Yellow—2.51-----	30.48 30.68 30.28	Aprx 1 min----- Aprx 1 min----- Aprx 1 min-----	----- ----- -----	Average
34	Cartridge, 105-mm, smoke, WP, M60.	WP—4.06----- FS—4.61-----	33 33	Immediately-- Immediately--	WP smoke, 1 yellow band---- FS smoke, 1 yellow band----	13 15
35	Cartridge, 105-mm, gas, H, M60.	H—3.17-----	33	3 to 10 days--	H gas, 2 green bands-----	10
	<i>105-mm rifle</i>					
36	Cartridge, 105-mm, smoke, WP, M325.	WP—4.06-----	34.58	Immediately--	WP smoke, 1 yellow band----	11
	<i>4.2-in. mortar M2</i>					
37	Cartridge, 4.2-in. gas, M2-----	CNB—5.45-----	22.8	Several hours to 6 days.	CNB gas, 1 red band-----	23

See footnotes at end of table.

	1	2	3	4	5	6
1	Munition	Agent and weight of filling (lb unless otherwise indicated)	Weight of filled projectile (lb unless otherwise indicated)	Approximate time for agent to burn or evaporate at point of release ²	Marking and color	Chemical efficiency (percentage) ³
		CNS—7.0-----	24.3	Several hours to 6 days.	CNS gas, 1 red band-----	28
37	Cartridge, 4.2-inch gas, M2— Con.	CG—6.25----- CK—5.0----- H—6.2----- HD—6.0----- HT—5.75-----	23.55 22.6 23.0 23.5 22.6	5 to 10 min--- 5 to 10 min--- 3 to 10 days-- 3 to 10 days-- Longer than H or HD.	CG gas, 1 green band----- CK gas, 1 green band----- H gas, 2 green bands----- HD gas, 2 green bands----- HT gas, 2 green bands-----	26 21 26 25 28
38	Cartridge, 4.2-inch smoke, M2--- 155-mm gun	WP—7.5----- PWP—6.25----- FS—7.5----- FM—7.5-----	24.8 23.1 25.1 25.1	About 1 min--- 2 to 3 min--- Immediately-- Immediately--	WP smoke, 1 yellow band---- PWP smoke, 1 yellow band---- FS smoke, 1 yellow band----- FM smoke, 1 yellow band-----	30 26 30 30
39	Projectile, 155-mm, gas, M104--	H—11.7-----	94.81	3 to 10 days--	H gas, 2 green bands-----	12
40	Projectile, 155-mm, smoke, M104.	WP—15.6----- FS—16.9-----	98.71 97.34	Immediately-- Immediately--	WP smoke, 1 yellow band----- FS smoke, 1 yellow band-----	16 17
41	Projectile, 155-mm, gas, GB, M122.	GB—6.3-----	95	-----	GB gas, 1 green band-----	7
	155-mm howitzer					
42	Projectile, 155-mm, smoke, M110.	WP—15.6----- FS—16.9-----	98.39 99.69	Immediately-- Immediately--	WP smoke, 1 yellow band---- FS smoke, 1 yellow band-----	16 17
43	Projectile, 155-mm, smoke, BE, M116.	HC—25.84----- Colored ¹ —18.14---	94.35 86.44	About 2 min--- 30 sec to 4 min	HC smoke, 1 yellow band---- 1 yellow band; color indicated	20 20
44	Projectile, 155-mm, gas, CNS, M110.	CNS—13.8-----	94.49	Several hours to 6 days.	CN gas, 1 red band-----	14
45	Projectile, 155-mm, H, M110----	H—11.7-----	94.49	3 to 10 days--	H gas, 2 green bands-----	14
46	Projectile, 155-mm, gas, GB, M121.	GB—6.3-----	95	-----	GB gas, 1 green band-----	-----
	Fire starter					
47	Starter, fire, NP3 M2-----	NP3 thickened kerosene—0.01.	9.93	4 min-----	1 purple band; one end of fire starter is painted red.	33

¹ Color: red, yellow, green, violet. For air-ground and other signaling.

² Variable, depending on the amount of agent released, type of agent, terrain, and meteorological conditions.

³ Ratio filling to total weight.

⁴ Estimated averages based on wide variations in zone weights.

d. Chemical Ammunition Requirements.

(1) Smoke shell.

(a) *Rounds per 100 meters per minute for combined screening and casualty effects, using white phosphorus (WP).*

	1	2	3	4	5
1	Wind direction	Follow- ing 6 o'clock	Head 12 o'clock	Flank 3 or 9 o'clock	Quar- tering
2	81-mm mortar-----	2.75	2.2	1.1	2.2
3	4.2-inch mortar-----	1.37	1.1	5.5	1.1
4	105-mm howitzer-----	9.9	7.7	1.6	6.6
5	155-mm gun or howitzer--	3.3	2.2	.55	2.2

- (b) *Rounds per 100 meters per minute for screening only.* To obtain number of rounds required, measure line to be screened in 100-meter increments. Multiply the number of increments by the quantity shown for the direction of the wind; multiply by number of minutes screen is to be maintained. Fire twice the number of rounds indicated during the first minute to establish screen.

*Rounds Per 100-meter Increments
Per Minute^{1 2 3 4}*

	1	2	3	4	5
1	Wind direction	6 or 12 o'clock		3 or 9 o'clock ⁵	
		WP	HC	WP	HC
2	81-mm mortar.....	1.65	-----	.88	-----
3	4.2-inch mortar.....	.77	-----	.44	-----
4	105-mm howitzer.....	4.4	3.3	1.6	.28
5	155-mm gun or howitzer..	1.4	3.3	.55	.28
6	Smoke pots, HC, M1 ⁶	-----	6.6	-----	3.3
7	Smoke pot, HC, 30-lb, M5 ⁶	-----	4	-----	1

¹ Table holds for winds up to 3 mPH

² For winds 3 mPH to 10 mPH, multiply results by 1.5.

³ For winds 10 MPH to 15 MPH, multiply results by 2.

⁴ Base ejection shell should be fired with mechanical time and superquick fuse M501 to give an air burst 1 to 2 seconds less than that used for zero height of burst.

⁵ Quantities are for smoke curtains up to 1,000 meters. For curtains of 1,000 to 1,200 meters, multiply values by 9; for curtains in excess of 1,200 meters, multiply values by 0.8.

⁶ For smoke pots, the quantities indicated are the number of pots that must be kept burning. The M1 smoke pots burn an average of 7 minutes and the M5 pots burn an average of 15 minutes; hence, the indicated quantities will screen 100 meters for that period.

(2) *Nerve gas (GB)—area coverage capability and casualty expectancy.¹*

	1	2	3	4	5	6	
1	Weapon	Lb ¹ round	Rounds per 30 sec per tube	Tubes per unit	Lb per 30 sec per unit	Area coverage in hectares (100-meter squares) ^{2 3}	
						Moderate casualties ⁴	Heavy casualties ⁵
2	105-mm howitzer.....	1.8	4	6 (btry)	43	3	1
		1.8	4	18 (bn) (corps)	130	10	4
3	155-mm howitzer.....	6.5	2	6 (btry)	78	6	2
		6.5	2	18 (bn)	234	18	7
4	155-mm gun.....	6.5	2	4 (btry)	52	4	2
		6.5	2	12 (bn)	156	12	5

¹To produce casualties through imperfect gas discipline or surprise in open terrain or sparse woods.

²The downwind drift of casualty-producing dosages is significantly larger than the area covered in 30 seconds. A downwind hazard may exist for many miles downwind from the impact area.

³The meteorological conditions under which these calculations were made are neutral temperature gradient, wind speed of less than 12 MPH, and temperatures of 50 F. or above. Different meteorological conditions will require recalculation of capabilities.

⁴Based upon 13 pounds of GB per hectare, which, under average conditions (see note 3 above), should produce approximately 30 percent casualties (IC₃₀).

⁵Estimated to cover 50 percent of the target area with a medial lethal dosage (LC₅₀) within 30 seconds after initial impact. Calculations are based upon the application of 33 pounds of GB per hectare.

(3) *Mustard (HD) ammunition for liquid contamination effect.* Pounds per hectare for liquid contamination effect.

	1	2
	Ammunition	Rounds per hectare (100-meter sq) ^{1 2}
2	4.2-inch mortar HD shell-----	96
3	105-mm howitzer HD shell-----	160
4	155-mm howitzer HD shell-----	42
5	155-mm gun HD shell-----	42

¹ To maintain liquid contamination hazard, mustard must be added periodically as mustard evaporates (see TM 3-200 for detailed calculations).

² The rounds per hectare required for vapor effect may be markedly lower, depending upon meteorological conditions and time during which enemy personnel will be exposed (see TM 3-200 for detailed calculations).

(4) *Land mines, mustard (HD).* Effect is obtained by contamination.

Mines Required

	1	2
	Purpose	Mines required
2	Barriers-----	Ten parallel lines of mines 10 yards apart with mines staggered at 10-yard intervals in each line.
3	Large areas-----	40 mines uniformly spaced per 100 by 100 yard square.
4	Along roads-----	One line of mines on each side of the road with mines staggered at 10-yard intervals along each line.
5	Demolitions-----	Mines placed in lines 5 yards apart at 5-yard intervals along each line. The approaches to the demolition should be contaminated, using 40 mines per 100 by 100 yard square.

e. Chemical Land Mine Operations (see also par. 4.30c).

	1	2	3	4	5	6
		Squad task	Platoon task	Company task	Average time ¹	
1	Nature of task	1 truck (2½-ton)	4 squads	12 squads	Time fuze or detonating cord	Wire for electric firing
2	Barrier (100 yd deep)-----	300 yd wide 300 mines	1,300 yd wide 1,300 mines	5,000 yd wide 5,000 mines	4 hours	8 hours
3	Road contamination-----	1,600 yd 330 mines	6,400 yd 1,320 mines	19,200 yd 3,960 mines	15 to 20 minutes. ²	2 hours

¹ The time should be increased 50 percent for night work.

² Detonating cord laid from truck, mines placed on cord.

Section V. SIGNAL COMMUNICATIONS

4.20 General

a. These data are intended for use as general guides only. The highly technical nature of signal operations and varying security measures require that these data be applied only as recommended by the unit signal officer after modification according to local field conditions and in the light of the tactical situation.

b. For signal troop requirements in a typical field army, see paragraph 4.20(1) and (2).

c. For signal troop requirements in airborne operations, see paragraph 4.4; in the communications zone, see paragraph 4.3; and in amphibious operations, see paragraph 4.5.

d. For signal construction factors, see paragraph 8.13.

e. *Publications Governing Signal Communications.*

(1) Pertinent sections of the unit standing operating procedures (SOP) set forth the general principles under which the unit signal system will operate. Usually the SOP is governed by the provisions of that of the next higher headquarters and, in turn, serves as a guide for that of subordinate headquarters.

(2) Standing signal instructions (SSI) are published by the unit signal officer to provide permanent directions for the use of technical items of signal operation instructions.

(3) Signal operation instructions (SOI) contain the specific technical directions for the operation of the various means of signal communication. They include

separate items providing such information as telephone directory code names and numbers, radio call signs and frequencies, unit code and ciphers, and pyrotechnic signals. Because changes in items of SOI occur frequently, paragraph 5 of the field order specifies the current index.

- (4) Joint Army-Navy-Air Force Publications (JANAP) and Allied Communications Publications (ACP) contain joint and combined instructions, methods, and procedures pertaining to communications planning and operations.

4.21. Users Served by the Signal System

The military signal system in a theater of operations provides service for the following:

a. The Combat Zone Communication System.

- (1) Division.
- (2) Corps.
- (3) Army.

b. Communications Zone Communication System.

- (1) Army group.
- (2) Base, intermediate, and advance sections; depots and ports.
- (3) Intratheater tactical-administrative systems.

c. Communication Facilities as Required for—

- (1) Air defense.
- (2) Coordination of Army and Air Force activities, including facilities for the request of air support.
- (3) Coordination of Army and Navy activities.
- (4) Operation of military railways and pipelines.
- (5) Military police activities, including traffic control.
- (6) Personnel replacement systems.
- (7) Intelligence and counterintelligence activities.
- (8) Military government/civil affairs.
- (9) Psychological warfare activities.
- (10) Press, public relations, and special service activities.
- (11) Guided missile installations and activities.
- (12) Clandestine and guerilla warfare.

- (13) Interallied signal communication.
- (14) Electronic warfare.
- (15) Meteorological service.
- (16) Signal security activities.
- (17) Air traffic control.
- (18) Air navigation systems.
- (19) Identification, friend or foe, systems.
- (20) Army repair parts supply system.
- (21) Military highway communications.
- (22) POL supply.

4.22. Command Posts and the Area Communication System

a. The Area Communication System. The area communication system, with its grid configuration, provides the army, corps, and division units with subcenter installations through which they can establish a call to any point in the army area. The system is supplied primarily by six signal area communication battalions (army) at army level and by the signal battalion associated with each division. Essentially, the system is composed of radio-relay links for long lines of communication, the standard wire installations for internal command post communications, and local wire installations to connect subordinate and supporting units to the signal center. The signal centers are established geographically to provide alternate and advance command posts along both a forward and lateral plane. Communications facilities are supplied at each signal center installation to enable the movement of command posts from one location to another without disruption of the overall system. The signal center installation provides the maximum number of alternate routes for message handling to reduce probability of interruption of communications between major units. Initial long line connections between major headquarters at all levels will be radio relay; as the situation and equipment availability permit, these circuits may be replaced by a more secure physical wire system.

b. Command Posts. Each major headquarters installation at army, corps, and division level is furnished sufficient signal personnel and equipment to install, operate, and maintain a complete command post communication system. The time required to install the system will vary with the situation and size of the headquarters. Command and staff facilities will, in most cases,

be immediately available in the alternate signal center installations previously installed to provide the initial area system.

c. Movement. Military operations require frequent moves to facilitate efficient command control. The facilities required to provide signal communications to the command should be responsive to the command; i.e., they must have a high degree of flexibility. This is accomplished through the grid configuration used in the area communication system. Because movement causes a temporary partial reduction of the overall area communication system, movement of major headquarters should be as infrequent as the situation will permit. When it is necessary for the commander to establish a headquarters close to the front in a rapidly moving situation, facilities as required are made available to provide the necessary communications for the commander's group.

4.23. Communication Center

a. Function. The function of the communication center is to transmit, receive, and deliver messages by the most reliable means. The figures in this paragraph and in paragraph 4.24 apply to communication center operations and are based on World War II experience. Under present and future concepts of operations, the accuracy of these figures may vary widely.

b. Cryptographic Operations. Computed from afteraction reports of selected units in the ETO during World War II, and including messages sent by radio, teletypewriter and miscellaneous means.

	Division	Corps	Army	Army groups
Average code groups per month.	225,000	500,000	750,000	1,800,000

c. Precedence. The nomenclature for classes of procedure in the following table, compiled from afteraction reports in the ETO during World War II, has been changed to conform to present usage.

	Flash	Emergency	Operational immediate	Priority	Routine	Deferred
Percentage of all messages (Army HQ).	Negligible	Percent 8	Percent 30	Percent 23	Percent 39	Negligible

d. Speed of transmission. Computed to allow for operational signaling; repeating garbled groups, including address and signature; and receipting.

Means of transmission	Words per hour
Radiotelephone.....	80-120
Facsimile.....	100
Telephone.....	100-150
Panel (code groups per hour).....	15
Radiotelegraph.....	150-250
Teletypewriter (single line).....	500-800
Teletypewriter (duplex).....	1,000-1,500

4.24. Means of Signal Communication

a. General.

(1) *Military messages are transmitted by—*

- (a) Messenger, including scheduled and special foot, motor, and airplane messengers and officer couriers.
- (b) Wire circuits, including telephone, teletypewriter, and facsimile.
- (c) Visual, including flags, panels, lamps, and pyrotechnics.
- (d) Sound, including whistles, sirens, bells, loudspeaker systems, and small-arms fire.
- (e) Radio circuits, including teletypewriter, voice, CW, facsimile, and data and special emissions.
- (f) Ancillary devices, such as data processing and transmission facilities and special communication devices.

(2) *Use of means of signal communication.*

Messenger, wire, radio, and radio relay are used for communication within and between division, corps, army, and higher headquarters. In addition to these means, visual and sound systems are used in air-ground signaling, in amphibious operations, for emergency communication within small units, and as warning signals.

b. Radio.

(1) *General.* The amount of traffic that is handled by radio—exclusive of messages handled via radio-relay equipment installed as part or in lieu of the wire net—depends upon the type of unit and the rate of displacement. In general, radio forms a standby means

of communication during static conditions when its operation would provide information to enemy intercept and analysis; but in fast-moving situations when it is difficult to extend wire lines rapidly enough and when units disperse on a wide front, radio becomes a major means of communication.

(2) *Radio traffic of selected units in the ETO during World War II.*

	Armored division	Infantry division	Corps	Army	Army group
Average messages per month.	2,400	200	500	9,500	3,800
Average code groups or words per month.	-----	35,000	85,000	163,000	650,000

c. *Television.* The application of military television is divided into two categories—non-combat and tactical.

- (1) *Noncombat*—to be used in the zone of interior and the communications zone; e.g., training, conferences, etc.
- (2) *Tactical*—to be used by army, corps, and division; e.g., fire control, surveillance and reconnaissance, etc.

d. *Wire.*

- (1) *General.* Wire communication networks provide the most secure means of electrical transmission of messages. Relative security depends upon geographic location of the net, the tactical situation, local security measures, the type of equipment being used, and the type of conductor employed in the line. The transmission of classified messages in the clear over these circuits will be resorted to only when the urgency of the tactical situation outweighs the security requirements.
- (2) *Telephone.* Each headquarters is provided with enough telephone facilities to satisfy normal operating requirements, provided that proper use is made of written messages for traffic not adapted to telephonic transmission. During World War II, unit switchboards in the European Theater handled the following average of calls:

	Division	Corps	Army	Army group
Calls per day-----	2,000	5,000	12,500	18,000

- (3) *Teletypewriter.* The following table shows the average number of teletypewriter messages handled by various types of headquarters in the ETO during World War II.

	Division	Corps	Army	Army group
Messages per month--	750	4,000	11,500	28,000

- (4) *Construction.* For figures on permanent and semipermanent wire construction, consult paragraph 8.13.

(a) *Rates of wire line construction.*

	Foot troops	Reel trucks	Signal construction battalion
Field wire-----	1½ mph/3-man team.	3-5 mph/6-man team.	30 miles per week.
Spiral-4 cable (on existing support).	-----	1 mph/8-man team.	
Open wire (10-wire pole line).	-----	-----	

- (b) *S-4 cable and field wire laid to next subordinate headquarters by selected units during World War II in the ETO.*

Miles per month of—	Division	Corps	Army
Field wire-----	450	-----	-----
Cable and field wire-----	-----	700	1,300
Open wire-----	-----	-----	500

- (c) *Average rate of wire lines over a 6-month period during World War II in the ETO by a well-trained division signal company.*

	Daylight	Night	Average time out day and night
Elapsed time in minutes----	70	120	95

e. *Messenger.*

- (1) The rate of travel of various types of messenger is listed below, no consideration being given to traffic restrictions, climate, or weather:

Kind of messenger	Rate of travel in miles per hour	
	Day	Night
Dismounted (runner)-----	3-5	2-4
Motor-----	25-40	15-30
Aircraft:		
Fixed-wing-----	90-160	90-160
Rotary-wing-----	60-100	60-100

- (2) Each headquarters is furnished organic messenger facilities. The bulk of messenger traffic is carried by motor messenger. The capabilities of motor messenger service available to units are indicated below.

	Division	Corps	Army
Miles of route per month---	7,000	30,000	90,000
Pouches and messages-----	17,000	50,000	150,000

- (3) The quantity of messages that can be transmitted by messenger and the speed of transmission are increased when messages are accounted for in the communication center by pouch instead of by individual message.

4.25. Special Communications Requirements

a. General. Certain intersectional services require special communication facilities. Whenever possible, these requirements are integrated into the area communication system. Special requirements of these services are presented in the following subparagraphs.

b. Military Railway Service Communications Data. A military railway service (MRS) communication system normally consists of open wire facilities. As an *ultimate* overseas necessity, VHF radio and VHF/UHF radio relay may be required.

- (1) Two metallic pairs are required to provide the telephone and teletypewriter circuits needed. Open wire leads may or may not closely follow the railway, but circuits must be available at each way station and dispatcher's office.
- (2) Associated equipment with open wire lines usually consists of telephone dispatching equipment, simplex and composite sets, telephone and telegraph voice-frequency repeaters, and may

include use of telephone carrier facilities.

- (3) VHF radio may be used in railroad yard areas for yard-to-engine operation.

- (4) VHF/UHF radio relay may be used between adjacent division dispatcher's offices and from division dispatcher to way stations, where wire lines experience frequent outages because of hostile action and where backup communications are required. It is valuable also during operations requiring speed of installation.

- (5) Circuit requirements—

(a) Dispatcher to way stations.

(b) Way station to way station.

(c) Dispatcher to dispatcher.

1. Telephone.

2. Teletypewriter.

(d) Division headquarters to MRS headquarters.

1. Telephone.

2. Teletypewriter.

c. Military Pipeline Communications Data.

- (1) Military pipeline communications may be provided on allocated channels of the integrated theater system. In geographical areas where it is not feasible to utilize the theater system, a radio-relay system may be used.

- (2) VHF radio facilities are provided at each pumping station, tank farm complex, and district dispatcher's office for communication to aerial and ground mobile units. This equipment further provides emergency communication between these elements.

- (3) High-frequency radio facilities are provided for emergency communication between the chief dispatching station and each district dispatcher.

- (4) Equipment associated with the system consists of telephone dispatching systems, teletypewriter sets, simplex and composite sets, telephone and telegraph voice-frequency repeaters, and may include telephone carrier systems.

- (5) For planning purposes, it is estimated that approximately 65 percent of the total pipeline communication circuit requirements in an overseas theater

will be provided from the integrated theater signal system. This estimate is based upon the assumption that the pipelines and the axes of the integrated theater signal system will generally follow the same routes along the line of communications. The remaining 35 percent of the pipeline communication circuit requirements will be provided by the Signal Corps as separate construction to support the POL system.

d. Military Highway Communications Data.

- (1) A military highway communications system usually consists of fixed VHF radio stations, with the stations located at strategic intervals of approximately 40 or 50 miles. These stations may be situated adjacent to the traffic control posts (TCP) and highway regulating posts (HRP) or may be situated at the same location. The fixed radio stations are connected by open wire lines or VHF/UHF radio facilities to the nearest area long distance (LD) and local switching center (Signal Corps) in order to provide access to the integrated theater signal system. This connection also enables the strategically located highway radio stations, TCPs, and HRPs to communicate with each other and also to communicate with ports, depots, headquarters, and other areas.

- (2) The fixed VHF radio stations enable the radio-equipped vehicles, normally military police and some transportation or ordnance vehicles, to communicate with the nearest TCP and HRP while moving or stopped. All such radio contact depends upon the terrain, location of fixed and vehicular radio sets, and other factors affecting radio transmission.
- (3) In addition to radiotelephone communication between fixed and vehicular radio stations, telephone and teletypewriter circuits are provided via the open wire or radio-relay facilities between the fixed radio stations serving the TCPs and HRPs.
- (4) The fixed radio stations are operated by the Signal Corps in order to provide maximum economy of equipment, radio frequencies, speed of service, and efficiency to the various services and units requiring communications along the military highway system. At each fixed radio station, a small switchboard, when required, is also operated by the Signal Corps, with local telephone connections to the various adjacent services operating the TCPs and the HRPs. In some instances, the fixed radio station will be located at or near an area LD and local switching center and will use its switchboard facilities.

4.26. Characteristics of Signal Equipment

a. Wire and Cable.

	1	2	3	4
	Nomenclature	Description	Range	Remarks
1				
2	Wire, WD-1/TT-----	Field telephone wire-----	24 mi-----	Twisted pair employed throughout division, corps, and army.
3	Cable, CX-1065/G-----	4- and 12-channel field carrier cable assembly.	N/A-----	Spiral-4 furnished in ¼-mile lengths Employed throughout division, corps, and army.
4	Cable, 162/G-----	5 pair voice-frequency, field telephone cable.	24 mi-----	Furnished in 100-, 300-, 500-, and 1,000-foot lengths. Employed throughout division, corps, and army.
5	Reel unit, RL-26E-----	Gasoline engine-driven 2-axle unit for pickup and payout of field wire and cable.	N/A-----	Payout of wire and cable up to 30 miles per hour. Employed within division, corps, army, communications zone, and zone of interior.

	1	2	3	4
	Nomenclature	Description	Range	Remarks
6	Reel unit, RL-31E-----	A-frame with divided axle. Manual operation.	N/A-----	Can be vehicular mounted. Employed throughout division.
7	Axle, hand, RL-27D-----	Portable wire-laying unit carried by one man.	N/A-----	Pays out and recovers ¼-mile field wire, WD-1/TT, or spool, DR-8. Employed at company level and above.
8	Wire dispenser, MX-306 A/G.	Contains ½ mile of field wire, WD 1/TT.	N/A-----	Wire may be payed out from man pack, ground vehicle, or airplane. Wire can be projected by bazooka, rocket, or rifle grenade. Employed at company, battle group, and regiment levels.
9	Reel equipment, CE-11---	Portable wire-laying unit-----	N/A-----	Consists of reel unit, RL-39, and sound powered telephone, TS-10. Employed at company level.
10	Central office telephone, manual, AN/TTC-7.	Complete mobile telephone central office.	N/A-----	Capable of terminating 200 lines common or local battery and 40 trunk circuits. Expandable to a capacity of 1,000 lines, common or local battery, and 160 trunk circuits by adding components and positions of additional AN/TCC-7s. Employed at corps and army levels.
11	Switchboard, telephone, SB-18/PT.	Light, portable, emergency switching equipment for local battery telephone lines.	N/A-----	Six-line capacity. Employed at company level.
12	Switchboard, telephone, SB-22/PT.	Portable switching equipment for local battery lines, teletypewriter, and remote control radio communications.	N/A-----	Twelve-line capacity. Employed at company, battle group, and regiment levels.
13	Switchboard, telephone, SB-86/P.	Provides 30 lines, has a capacity of 60 lines with the addition of a switchboard signal assembly. Provides magneto lines, common battery trunks to manual civilian exchange and common battery supervision.	N/A-----	Employed at battle group, regiment, division, corps, and army levels.
14	Telephone, TA-312/PT---	A rugged, lightweight, waterproof telephone set designed for common or local for battery operation.	N/A-----	Employed throughout division.
15	Telephone, TA-236/FT---	A fixed station telephone desk set designed for common battery operation.	N/A-----	Similar to commercial telephone desk set. Employed at corps and army levels.
16	Telephone, TA-1/PT-----	Field type sound powered-----	5 mi-----	A sound-powered telephone intended for use on field wire lines to provide visible and audible signals. Employed in forward areas and at company level with Army field telephone or local battery switchboard.
17	Remote control, AN/GSA-7.	Remote control unit to interconnect radio circuits with local battery telephones on a dc push-to-talk basis.	N/A-----	Employed throughout division.

	1	2	3	4
1	Nomenclature	Description	Range	Remarks
18	Telephone, TA-264-----	A portable amplifier telephone set designed to provide communications over greater distances than those obtained with ordinary local battery telephone sets.	N/A-----	Employed at division, corps, and army levels.
19	Teletypewriter, AN/PGC-1.	Send/receive lightweight page printer.	N/A-----	Employed at battle group, regiment, division, corps, and army levels.
20	Teletypewriter, AN/GGC-3.	Portable; send/receive typing reperforator and tape transmitter.	N/A-----	Employed in division, corps, and army.
21	Teletypewriter, AN/FGC-20.	Page printing teletypewriter set used to transmit, monitor, and receive messages in fixed plant stations and communication centers.	N/A-----	Employed in communication zone signal systems.
22	Terminal, telegraph, AN/TCC-4.	A lightweight, portable tactical telegraph terminal which will provide 8 full duplex teletypewriter channels over one 4-kc telephone channel on a 2 or 4 wire basis.	N/A-----	Employed at division, corps, army, and communications zone levels.
23	Terminal, telegraph, telephone AN/TCC-14.	Terminal to provide simultaneous telephone and teletypewriter service over normal telephone circuit.	N/A-----	Employed at battle group, division, corps, and army levels.
24	AN/MTC-3-----	Mobile central office capable of interconnecting 120 local telephone lines.	N/A-----	Employed at division level.
25	AN/MTC-7-----	Mobile central office capable of interconnecting 60 local telephone lines.	N/A-----	Employed at battle group level.
26	AN/MGC-17-----	Mobile switching central capable of interconnecting 29 voice-frequency teletypewriter circuits or local telephone lines.	N/A-----	Employed at battle group level.
27	AN/MSC-29-----	Mobile teletypewriter operations, unit having facilities for 4 duplex or 8 half-duplex voice-frequency teletypewriter circuits. Provision is also made for on-line and off-line cryptographic facilities.	N/A-----	Employed at division, corps, and army levels.
28	SB-11()/MRC-----	Flexible mobile switching unit capable of terminating 624 circuits, and testing and monitoring facilities are included.	N/A-----	Employed at battle group and division levels.

b. Television.

	1	2	3	4
1	Nomenclature	Description	Range	Remarks
2	Model A-2-----	Lightweight airborne TV system for reconnaissance and aerial observation.	N/A-----	Employed at battle group, regiment, and division levels.

c. Radio and Radio Relay.

	1	2	3	4
	Nomenclature	Description	Range	Remarks
2	AN/GRC-3 } —Armor--- AN/GRC-4 } AN/GRC-5 } —Artillery-- AN/GRC-6 } AN/GRC-7 } —Infantry-- AN/GRC-8 }	Vehicular, frequency-modulated radio sets that provide short-range radio-telephone facilities within the frequency range of 20 to 58.4 mc. Short range for tank and command vehicle communication.	15 mi stationary; 10 mi moving.	Employed within and between armored, artillery, and infantry units.
3	AN/VRC-8 Armor----- AN/VRC-9 Artillery----- AN/VRC-10 Infantry-----	Same set as AN/GRC-4, 6, 8, except interphone and retransmission facilities not provided.	15 mi stationary; 10 mi moving.	Usually provided for open vehicles. Employed throughout division.
4	AN/VRQ-1 Armor----- AN/VRQ-2 Artillery----- AN/VRQ-3 Infantry-----	Basically consists of 2 AN/VRC-8, 9, or 10 sets on a single mounting.	15 mi stationary; 10 mi moving.	Used for radio-relay purposes to extend operating range.
5	AN/PRC-8 Armor----- AN/PRC-9 Artillery----- AN/PRC-10 Infantry-----	Man-packed portable, frequency-modulated radio sets intended to provide radio-telephone communications within and between armored, artillery, and infantry units.	3 to 5 mi-----	Can be operated as man-packed, portable, vehicular, aircraft, or ground installation. Employed at company, battle group, and division level.
6	AN/PRC-6-----	Portable, short-range battery-operated radio receiver-transmitter.	1 mi-----	Employed by company and battle group.
7	AN/ARC-44-----	Set installed in Army aircraft for communication with the AN/GRC/3 through 8 series.	Line of sight-----	Employed throughout division, corps, and army.
8	AN/GRC-10-----	Portable radio-relay set; used in conjunction with tactical wire carrier equipment to provide multichannel telephone, teletypewriter, or facsimile service or used independently to provide a single communication channel.	25 mi (line of sight) --	Employed throughout airborne divisions and missile commands by signal personnel.
9	AN/TRC-24-----	A high quality radio-relay set, designed to operate with telephone carrier equipment to provide 12 telephone, teletypewriter, or facsimile channels or a combination of these channels.	Up to 50 mi (line of sight) per jump and 200 mi per radio-relay system.	Employed at battle group, division, corps, and army levels.
10	AN/MRC-68-----	Mobile 4-channel radio-relay station; principal components include 1 radio set, AN/GRC-40; 2 telephone terminals, AN/GCC-3; converter; and a trailer-mounted generator set.	40 mi-----	Employed throughout airborne divisions and missile commands by signal personnel.
11	AN/MRC-69-----	Mobile 12-channel radio-relay station; principal components include radio set, AN/GRC-35; telephone terminal, AN/TCC-7; converters; filter assemblies; and a trailer-mounted generator set.	Up to 50 mi (line of sight).	Employed at battle group and division levels.

	1	2	3	4
1	Nomenclature	Description	Range	Remarks
12	AN/GRR-5-----	Portable or vehicle-mounted utility, AM radio-receiver, providing reception of voice, CW, and MCW signals within the frequency range of 1.5 to 18 mc.	N/A-----	Employed through division, corps, and army.
13	AN/GRC-19-----	A 100-watt vehicle radio set, providing AM voice, CW, and frequency shift keying facilities within the frequency range of 1.5 to 20 mc.	Ground-wave—50mi; sky-wave—150 to 1,500 mi.	Employed at division, corps, and army levels.
14	AN/GRC-46-----	A vehicular AM radio set mounted in a shelter, S-89/G; provides voice, CW, or frequency shift radioteletypewriter operation over a transmission frequency of 1.5 to 20 mc and a reception frequency range of .5 to 32 mc.	Ground-wave—50 mi; sky-wave—up to 1,000 mi.	Employed throughout division.
15	AN/GRC-29-----	Same set as AN/GRC-46 without shelter.	50 mi-----	Employed at division, corps, and army levels.
16	AN/GRC-26-----	A mobile AM radio set with facilities for frequency shift transmission and reception of radioteletypewriter signals on a frequency range of 2 to 8 mc; full-duplex, half-duplex, or one-way reversible operation. Voice transmission may be used alone and simultaneously in voice and teletypewriter operation.	RATT-250 mi; voice—100 mi. Extended ranges with doublet antenna.	Employed throughout division, corps, and army.
17	AN/MRC-54-----	Complete mobile radio-relay repeater. Used in conjunction with AN/MRC-69 as a repeater or with an AN/TCC-7 as a terminal. Basically consists of three AN/TRC-24s.	50 mi-----	Employed throughout area communication system by signal battalion personnel.

d. Photographic.

	1	2	3	4
1	Nomenclature	Description	Range	Remarks
2	KS-10 (ground)-----	16-mm motion picture camera	N/A-----	Employed at division, corps, and army levels.
3	KA-20 (air)-----	Day aerial camera, taking general purpose (vertical and oblique) photos. Camera has 6" lens and produces 9" x 9" negative. Image motion compensation adjustable to altitudes of 600, 1,000, and 1,500 feet only.	N/A-----	Employed at division and corps levels. Can be used in drone or L-19 aircraft.

	1	2	3	4
1	Nomenclature	Description	Range	Remarks
4	KS-36 (air)-----	Day/night aerial camera, taking general purpose (vertical and oblique) photos. Camera has interchangeable 6" x 12" lens and produces 4½" x 4½" negatives. Image motion compensation adjustable to altitudes of 1000', 2000' and 3000'.	N/A-----	Employed at division and corps levels.
5	KS-4 (ground)-----	Hand-held utility camera-----	N/A-----	Employed at battle group, regiment, division, corps, and army levels.
6	KS-5 (ground)-----	35-mm motion picture camera---	N/A-----	Employed at division, corps, and army levels.
7	KS-6 (ground)-----	Hand-held utility camera-----	N/A-----	Battle group, regiment, division, corps, and army.
8	AN/TFQ-7-----	Complete mobile photographic darkroom capable of processing still and aerial negatives in widths from 35-mm to 9½".	N/A-----	Division and corps.

e. Facsimile Equipment.

	1	2	3	4
1	Nomenclature	Description	Range	Remarks
2	RC-120-----	Transmits and receives pictures, maps, or messages in sizes up to 7" x 8⅝" over a radio or wire voice communication channel.	N/A-----	Requires one voice circuit. Transmission time—7½ minutes per page. Employed at division, corps, and army.
3	AN/TXC-1-----	Transmits or receives pictures, maps, or messages in sizes up to 12" x 18⅛".	N/A-----	Requires one voice circuit. Transmission time—20 minutes per page. Employed at division, corps, and army.

f. Public Address Equipment.

	1	2	3	4
1	Nomenclature	Description	Range	Remarks
2	AN/PIQ-1-----	Pack carried public address set for instruction and training.	600 ft.	Indoor, outdoor, and mobile operation.
3	AN/TIQ-2-----	General purpose PA system for large audiences.	N/A-----	
4	AN/TIQ-3-----	Outdoor intercommunication and PA for widely dispersed areas.	500 yd	
5	AN/TIP-2-----	High power PA system for noisy area.	2,500 yd.	

g. Combat Surveillance.

	1	2	3	4
1	Nomenclature	Description	Range	Remarks
2	Ground Radar Surveillance Set AN/PPS-4.	Portable forward area radar surveillance equipment, used to locate and identify moving targets.	-----	Employed at company level.
3	Ground Radar Surveillance Set AN/TPS-21.	Vehicular portable forward area radar surveillance equipment, used to locate and identify moving targets.	-----	Employed at battle group level.
4	Ground Radar Surveillance Set AN/TPS-25.	Vehicular portable forward area radar surveillance equipment, used to locate and identify moving targets.	-----	Employed at division, missile commands and lower levels.
5	Surveillance Drone Systems (AN/USD-1 and succeeding items).	Unmanned, airborne forward area surveillance system.	-----	Employed at field army and lower levels, systems currently mount KA-20 aerial camera. Improved cameras as well as other sensors, data links, navigational equipment, IFF and beacon equipment will be mounted as developed.
6	Ground Control Radar System, AN/MPQ-29 and succeeding items.	Vehicular mounted drone surveillance radar control system.	-----	Employed with both manned aircraft and surveillance drones as positioning and locating equipment, systems include associated display, command control and communications equipment.
7	Airborne Surveillance Radar (SLAR System) AN/APS-85-94 and succeeding items.	Aircraft Mounted "Side Looking Surveillance Radar" system.	-----	Employed at field army, corps, missile command and division levels. System will include data link and other ancillary equipment.
8	Airborne Surveillance and Mapping Radar System, AN/APQ-55.	Aircraft mounted "Side Looking, High-Resolution Surveillance and Mapping Radar" System.	-----	Employed at Field Army Corps, Missile Command and Division levels. System will include data link and other ancillary equipment.
9	Camera system, aerial surveillance, KA-20 and succeeding items.	Surveillance Camera, mounted in drones and manned aircraft. Day and night photo-reconnaissance capability.	-----	Employed at all levels from Battle Group up. Camera system includes wing mounting pods for cameras, flash and other illuminating devices, mounting hardware and other ancillary equipment.

Section VI. FIELD ENGINEERING

4.27. General

These data are intended for use as general guides only. Their application should be varied to conform to local field conditions as required in each specific tactical situation, based on the recommendation, after reconnaissance, of the unit engineer charged with the task.

4.28. Roads and Bridges

a. Traffic Capacity. See paragraph 7.15.

b. Load Capacity of Civilian Bridges. Peacetime design includes high safety factors for unusual loads and deterioration. As a guide for military operations, it may be assumed that the ordinary civilian bridge in good condition will

carry twice the rated civilian capacity when restrictions are placed on the speed and spacing of vehicles and on the number of lanes in use. However, it is advisable to have bridge capacity analyzed by an engineer officer.

c. *Road Capacity.* The capacity of a road is limited usually by the capacity of the bridges thereon.

d. *Marking Bridges and Vehicles.*

(1) Bridges are marked with two types of signs: circular and rectangular. Circular signs, by means of symbols and numerals, indicate the 1-way capacity classification of a bridge, wheeled or tracked class or both, as well as the capacity classes of a 2-lane bridge when used as either a double- or single-lane bridge. The capacity of 2-way bridges is marked by vertical arrows under 2 respective 1-way and 2-way class numbers. When dual classification of bridges is to be posted, the wheeled and tracked classes are denoted by silhouette-type symbols together with the appropriate class numbers. When desired, rectangular signs located beneath the bridge class signs indicate any other information concerning the bridge such as height or width limitations. Any bridge class which is a fraction of a whole number is *reduced* to the next lower whole number; for example, 22.7 would be reduced to 22.

(2) Vehicles are marked with class numbers which represent the effect a vehicle will have on the bridge when crossing it; the effect is determined from the gross weight of the vehicle and the weight distribution. Classification numbers are assigned to all single vehicles in military use which have a gross weight exceeding 3 tons, and to all trailers in military use which have a rated payload exceeding 1½ tons. All *single* vehicles in excess

of 3 tons gross weight carry front class signs only; a side vehicle classification sign is placed on the right side of classified *towing vehicles and trailers* exceeding 1½ tons. For *combination* vehicles, each leading vehicle in the combination carries a front vehicle's classification sign. It is inscribed with the classification number of the combination with the letter C in red above the classification number. In addition, each vehicle in the combination carries a side vehicle classification sign inscribed with its classification as a single vehicle. In the case of towed vehicles, when the vehicles are less than 30 yards apart and both are on 1 bridge span at the same time, they are classed as combination vehicles. In these cases, the classification of the combination is the sum of the classification numbers of the separate vehicles. This combination classification number is shown on a temporary front sign. Special purpose vehicles are equipped with front classification signs or side classification signs, depending upon their means of propulsion. For more detailed information, see FM 5-36.

e. *Road Nets.* See paragraph 8.5.

f. *Engineer Road Construction.* The net effective man-hours required for personnel of the engineer battalion to clear, grub, strip, and rough-grade 1 mile of combat road, pioneer type, are as follows:

Man-hours¹

	1	2	3
	Terrain	14 feet one-way	22 feet two-way
1			
2	Flat—prairie.....	1,500	2,000
3	Rolling.....	2,000	2,500
4	Hilly—forested.....	2,500	3,000

¹ Not included are requirements for the following tasks:

- (1) Graveling and culvert construction. See paragraph 8.5b.
- (2) Bridge construction. See paragraph 4.29c and d and 8.5b.
- (3) Road rehabilitation. See paragraph 8.5c.

4.29. River-Crossing Equipment

a. Distribution of Floating Equipment.

	1	2	3	4	5	6
	Item	Inf div enr bn	Armd div enr bn	Abn div enr bn	Engr pon brg co	Engr float brg co
2	Boat, assault, plastic, 16 ft.....	18	27	10		
3	Boat, recon, pneumatic, 3-man.....	18	3	6	1	2
4	Boat, brg erection, gas, single screw, 19 ft.....				1	4
5	Boat, brg erection, gas, twin screw, 2 section, 27 ft.....		6		3	2
6	Bridge, floating, M4 ¹				1	
7	Bridge, floating, hwy, aluminum deck, balk on pneumatic floats.....		3			5
8	Bridge, fixed, aluminum, hwy type, 38 ft, long span.....	3		3		
9	Bridge, floating, foot, aluminum.....					1
10	Ferry conversion set, raft, inf support.....					4
11	Construction outfit raft, set No. 1, inf support.....	2				12
12	Bridge, floating, pneumatic float, cl 60 ¹ , steel superstructure.....					1
13	Boat, assault, M2 ²					70

¹ Limited standard item.

² To be issued pending availability of plastic assault boat. Item is a component of construction outfit raft, set No. 1.

b. Characteristics of Boats and Rafts.

(1) Assault and storm boats.

	Boats	Engr crew, num- ber of men	Various maximum loads per boat, in addition to crew	Max- imum stream velocity (FPS)	Time in min for round trip across stream with width of		
					300 ft	500 ft	1,000 ft
2	Single assault boat, M2 w/9 paddles. ¹	3	{ 12 riflemen with indiv eqp.....	4	4	6	10
3			{ 1 rifle sqd.....				
4			{ 1 hv MG sqd w/gun and 13 boxes ammo.....				
5			{ 1 81-mm mortar sqd w/mortar and 50 rounds ammo.....				
6			{ 2 LMG sqd w/guns and 20 boxes ammo.....				
7	2 assault boat ponton w/outboard motor.	2	{ 22 riflemen with indiv eqp.....	7		4	6
8			{ 15 riflemen with indiv eqp.....	9			
9	Storm boat ²	2	{ 7 riflemen with indiv eqp.....	11		3	4
10			{ 1 hv MG sqd w/gun and 9 boxes ammo.....				
11			{ 1 81-mm mortar sqd w/mortar and 24 rounds ammo.....				
12			{ 1 LMG sqd, 2 extra men, gun and 10 boxes ammo.....				
13	Boat, assault plastic, 16 foot, w/9 paddles for hand propulsion. ¹	3	{ 9 riflemen with indiv eqp.....	4	4	6	10
14			{ 1 8-man MG sqd w/2 .30 cal LMG and boxes of ammo.				
15			{ 1 9-man 81-mm mortar sqd with 1 81-mm mortar and 50 rounds of ammo.				

¹ Boat, assault, plastic, will replace the assault boat, M2, when present stockpiles of the assault boat, M2, are exhausted.

² Limited standard item.

(2) Raft capacities (classes) and propulsion requirements.

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
Type of raft	Number of pontoons or floats	Length		Erection crew	Operating crew	Normal crossing ²						Risk crossing ²						Type of power unit required ³	Transportation required for raft equipage	
		Overall (with ramps)	Loading space ¹			Stream velocity (FPS)						Stream velocity (FPS)							Number	Type
						3	5	7	8	9	11	3	5	7	8	9	11			
Infantry support ⁴	3 Normal	38' 0"	24' 0"	1 plat	1 sqd	1 8	1 8	2 4	(5) 2	-----	-----	1 10	1 9	2 5	(5) 3	(5) 2	-----	Out-board motors, 25 horse-power	1	2½-ton cargo tk. with pole trailer
	5 Normal	50' 0"	35' 9"			1 13	2 10	3 5	(5) 3	-----	-----	1 15	2 13	3 8	(5) 5	(5) 3	-----		2	2½-ton cargo truck with pole trailer.
	7 Normal	62' 0"	47' 9"			1 13 21	2 13 21	4 8 13	(5) 4 5	-----	-----	1 16 23	2 15 23	4 10 16	(5) 7 12	(5) 5 8	-----			
Widened steel tread-way ⁹	4 Reinforced	64' 11"	39' 3"	1 plat	1 sqd	1 (30) 35	1 (30) 35	2 (30) 35	2 (20) 25	7 3 (15) 20	-----	1 (40) 45	1 (40) 45	2 (35) 40	2 (25) 30	7 3 (20) 25	-----	27-foot bridge erection boats ⁸	4	5-ton bridge truck.
	5 Reinforced	76' 11"	45' 6"			1 (40) 45	1 (40) 45	2 (40) 45	7 3 (30) 35	3 (20) 25	-----	1 (45) 50	1 (45) 50	2 (45) 50	7 3 (35) 40	3 (25) 30	-----			
M4	4 Normal	87' 1"	51' 8"	1 plat	1 sqd	1 (50) 55	1 (50) 55	1 (50) 55	1 (50) 55	2 (50) 55	7 3 (40) 45	1 (55) 60	1 (55) 60	1 (55) 60	1 (55) 60	2 (55) 60	7 3 (45) 50	27-foot bridge erection boats ⁸	5	2½-ton bolster truck with trailer.
	6 Reinforced					1 (70) 75	1 (70) 75	1 (70) 75	2 (65) 70	3 (65) 70	5 (50) 55	1 (75) 80	1 (75) 80	1 (75) 80	2 (75) 80	3 (55) 60	-----		6	
	7 Reinforced					1 (85) 90	1 (85) 90	1 (85) 90	2 (80) 85	4 (80) 85	6 (55) 60	1 (90) 95	1 (90) 95	1 (90) 95	2 (90) 95	4 (65) 70	-----		7	
Class 60	4 Normal	92' 5"	51' 0"	1 plat	1 sqd	1 (40) 45	1 (40) 45	2 (40) 45	3 (35) 40	4 (35) 40	5 (25) 30	1 (50) 55	1 (50) 55	2 (50) 55	3 (45) 50	4 (35) 40	-----	27-foot bridge erection boats ⁸	5	5-ton bridge truck.
	5 Normal	107' 5"	66' 0"			1 (50) 55	1 (50) 55	2 (50) 55	7 3 (45) 50	4 (40) 45	5 (30) 35	1 (60) 65	1 (60) 65	2 (60) 65	7 3 (55) 60	4 (50) 55	5 (40) 45		6	5-ton bridge truck.
	5 Reinforced	92' 5"	51' 0"			1 (55) 60	1 (55) 60	2 (50) 55	7 3 (50) 55	4 (45) 50	5 (35) 40	1 (60) 70	1 (60) 70	2 (60) 65	7 3 (60) 65	4 (55) 60	5 (45) 50		6	5-ton bridge truck.
	6 Reinforced	92' 5"	54' 0"			1 (65) 75	1 (65) 75	2 (65) 75	3 (60) 70	4 (60) 65	6 (50) 55	1 (80) 90	1 (80) 90	2 (80) 90	3 (75) 85	4 (70) 80	6 (60) 70		6	5-ton bridge truck.

M4T6	4 Normal	87' 1"	51' 8"	1 plat	1 sqd	(50) 1 55	(50) 1 55	(45) 6 2 50	(40) 2 45	(35) 7 3 40	(30) 4 35	(60) 1 65	(60) 1 65	(55) 6 2 60	(50) 2 55	(45) 7 3 50	(35) 4 40	27-foot bridge erection boats ⁸	5	5-ton bridge truck.
	5 Rein- forced	88' 9"	50' 1"			(60) 1 65	(60) 1 65	(60) 6 2 65	(55) 7 3 60	(55) 3 60	(45) 5 50	(70) 1 75	(70) 1 75	(70) 6 2 75	(65) 7 3 70	(65) 3 70	(55) 5 60		5 plus 1	5-ton bridge tk. 1½ton cargo. tk.

Legend

INFANTRY SUPPORT RAFTS ONLY

1	Number of power units required.
8	Single vehicle capacity.
1	Number of power units required.
13	Single vehicle capacity.
21	Two vehicle capacity, approximately equal in weight.

ALL OTHER RAFTS

1	Number of power units required.
(65)	Upper figure is wheeled vehicle capacity.
75	Lower figure is tracked vehicle capacity.

Crossing characteristics	River width (ft)		
	250	500	1,000
Number of round trips per hour in 5 FPS current in daylight.	10	6	4
Rafts operated from one site..	1	2	3
Number of round trips per hour in 5 FPS current in blackout.	5	3	2

Notes

- ¹ Measured from outside edge to outside edge of end pontoons or float saddle beams.
- ² Capacities are based on loading rafts with center of gravity of loads 6' downstream from centerline of raft and on properly inflated floats.
- ³ Although not shown on table, outboard motors can be used to advantage on all rafts in current velocities up to 5 FPS.
- ⁴ Wheeled and tracked vehicles have the same ratings.
- ⁵ One 19-foot bridge erection boat per raft in currents of 8 and 9 FPS.
- ⁶ Three 19-foot bridge erection boats may be used here instead of two 27-foot boats.
- ⁷ One 19 and two 27-foot boats may be used here instead of three 27-foot boats.
- ⁸ One 19-foot bridge erection boat may be used in currents not over 4 FPS. In currents over 4 FPS, two 19-foot bridge erection boats may be substituted for one 27-foot bridge erection boat.
- ⁹ Limited standard item.

c. Characteristics of Standard Floating Bridges.

1		2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27
1	Type of bridge	Transportation required ¹	Construction time in hours ²				Construction party ³	Maintenance crew	Capacity in tons ⁴																		Traffic capacity and vehicular distance for safe crossings in daylight (except as otherwise noted) ⁸
			Stream widths						Normal crossing (posted capacity) ⁵						Caution crossing ⁶						Risk crossing ⁷						
									Stream velocities in feet per second																		
			150 ft	250 ft	500 ft	1000 ft			3	5	7	8	9	11	3	5	7	8	9	11	3	5	7	8	9	11	
2	Footbridge, aluminum, floating.	3 2½-ton trucks or 2 2½-ton trucks w/ 2 ½-ton trailers per 472-ft 6-in. bridge.	(9)	(9)	(9)		1 plat	1 sqd	Safe					(10)	(10)												Day: 75 men per minute. Night: 40 men per minute (moonlight); 25 men per minute (blackout) at normal 2-pace distance. ¹¹
3	M2 assault boat	Normal construction	1	1½	2½		1 plat	1 sqd	8	6	5					8	6	5				9	7	6			200 vehicles per hour; 90-ft distance between vehicles.
4		Reinforced construction	1½	2	3		1 plat	1 sqd	13	9	7					13	11	8				14	12	9			
5	M4 floating bridge.	1 5-ton bridge truck per 15 ft of bridge (normal construction).	3	5	8	14	1 ponton brg co plus 1 or 2 combat co	1 sqd	12(60) 60	(60) 60	(45) 50	(40) 45	(30) 35	(18) 20	(68) 68	(65) 65	(58) 59	(52) 53	(44) 46	(29) 31	(72) 72	(68) 68	(61) 62	(58) 59	(53) 54	(37) 39	400 vehicles per hour. See notes 5, 6, and 7.
6	Class 60 floating bridge.	1 5-ton bridge truck per 15 ft of bridge.	1½	2½	4½	8½	1 float brg co plus 1 or 2 combat co.	1 sqd	13(60) 65	(55) 65	(45) 55	(40) 50	(35) 45	(22) 25	(65) 70	(62) 67	(56) 61	(52) 56	(45) 49	(34) 37	(75) 79	(72) 77	(67) 72	(62) 67	(57) 62	(46) 50	400 vehicles per hour. See notes 5, 6, and 7.
7	M4T6 floating bridge.	1 5-ton bridge truck per 15 ft of bridge.	2	3	5	10	1 float brg co plus 1 or 2 combat co.	1 sqd	(50) 55	(45) 55	(40) 50	(35) 45	(30) 40	(25) 30	(60) 61	(58) 59	(54) 55	(49) 51	(45) 47	(35) 37	(68) 69	(66) 67	(62) 63	(59) 60	(54) 56	(43) 45	400 vehicles per hour. See notes 5, 6, and 7.

¹ Transportation for bridge equipment only. Additional needed for any construction equipment required and for troops..

² Includes unloading and construction only in daylight. Does not include access roads, assembly sites, abutments, or anchorages except as noted.

³ Average for trained troops and continuous daylight construction. Allowances are required for specific situations.

⁴ Based on abutments at levels within 12 inches of floating bridge deck level.

⁵ Vehicle anywhere on width of bridge deck. Speeds 3-15 mph for wheeled vehicles, 2-8 mph for tracked vehicles. Vehicle spacing as dictated by tactical commander. Minimum spacing 90 feet.

⁶ Center of vehicle within 12" of bridge centerline. Maximum speed 8 mph for wheeled vehicles, 5 mph for tracked vehicles. Minimum spacing 150', no sudden stopping, accelerating, or gear shifting.

d. Fixed Highway Bridges.

⁷ Center of vehicle within 9" of centerline and with guide. Maximum speed 3 mph. One vehicle on bridge. No stopping, braking, or gear shifting.

⁸ Traffic capacities are for all traffic moving forward or rearward.

⁹ This time does not include installation of the anchorage system.

¹⁰ In currents above 8 FPS, the capacities are reduced 20 percent.

¹¹ Decrease capacities by 20 percent in currents over 8 FPS. Capacities are based on minimum interval of 5' between men or 2 or less men per bay.

¹² Normal construction.

¹³ Reinforced construction.

¹⁴ Upper figures in parentheses represent wheel load class and lower figures represent tracked load class.

1	2	3	4																		5				6				
	Span	Classification ¹																											
		Panel bridges																		Beam bridges				Truss & girder bridges					
		Type T6 width 13' 6"				Bailey type, M2																		I-beam stringers ²		WF beam stringers ³		Truss ²	Girder ³
						Class																							
						Single-single			Double-single			Triple-single			Double-double			Triple-double			Double-triple								
N	C	R	N	C	R	N	C	R	N	C	R	N	C	R	N	C	R	N	C	R	30-foot span ⁴	60-foot span ⁴	27-inch depth ⁵	36-inch depth ⁵	90-foot span ⁴	48-inch depth ⁵			
30				30	42	47																							
				30	37	42																							
40				24	36	40																							
					34	38																							
50					33	36	75	83	88																				
				24	31	35	70	86	84																				
60				20	30	33	65	77	85																				
					29	32	65	73	79																				
70				20	24	30	60	68	78																				
					30	60	60	69	75																				
80				16	20	24	50	60	66	85	95	100																	
							55	60	64	80	90	90																	
90				12	16	19	40	50	55	65	74	82																	
							45	50	55	65	75	82																	
100				8	12	14	30	37	42	50	57	64	80	86	96														
							30	39	44	55	60	66	80	90	90														
110							20	30	34	35	47	52	65	72	80	90	100	100											
								32	36	40	49	54	70	76	83	90	90	90											
120	75						16	23	27	30	38	43	45	57	64	75	83	91											
									30	35	41	45	55	61	68	80	90	90										100	

See footnotes at end of table.

1	2	3	4																				5				6							
1	Span	Type T6 width 13' 6"	Classification ¹																															
2			Panel bridges																				Beam bridges						Truss & girder bridges					
3			Bailey type, M2																				I-beam stringers ²				WF beam stringers ³		Truss ²	Girder				
4			Class																															
			Single truss	Double truss	Triple truss	Single-single			Double-single			Triple-single			Double-double			Triple-double			Double-triple			Triple-triple			30-foot span ⁴	60-foot span ⁴	27-inch depth ¹	36-inch depth ⁵	90-foot span ⁴	48-inch depth ⁵		
	N	C	R	N	C	R	N	C	R	N	C	R	N	C	R	N	C	R	N	C	R	N	C	R										
5	Posted ca- pacity.	130							12	18	21	20	31 33	35 38	35 45	47 50	53 56	55 60	65 72	74 80	70 80	80 90	90 90											
		135	60																															
		140						8	14	17	16	24	29 31	30 35	39 42	44 48	45 55	57 62	64 70	70 70	80 90	88 90												
		150	50								12	18	22	24	32 35	36 40	35 45	47 51	54 58	60 60	77 85	85 90												
		160									8	15	17	16	25	30 33	30 35	37 41	45 48	55 55	69 78	80 89	80 75	100 90	100 90									
		165	40	85																														
		170									4	10	13	12	19	24	20	31 34	36 40	45 50	57 64	64 74	70 70	80 90	90 90									
		180		75										8	15	18	16	24	29 32	35 45	48 53	55 60	55 60	66 75	77 87									
		190															12	18	22	30 35	39 43	46 51	45 55	59 66	68 77									
		195		65	110 100																													
		200																		20	32 36	38 43	35 40	48 52	55 62									
		210		55	90 100															16	25	31 35	24	38 43	46 51									
		105	95																															
		225			75 80																													

¹ Upper figure represents wheeled load class. Example: 46%. Lower figure represents tracked load class.
² With one line of traffic.
³ 22-foot roadway.
⁴ Length of one unit.

⁶ Values are approximate only and are subject to change due to revised packaging and changes in components of sets.

⁷ Does not include time for preparation of approach roads, assembly sites, and elaborate abutments. Adjustments must be made for specific site conditions.

e. Railway Bridging Equipment.*

	1	2	3		4		5	6	7	8	9	10			
		I-beam railway bridge	Unit construction railway bridge		Through truss railway bridge		Light standard (L-type) unit steel trestle	Standard (T-type) unit steel trestle	V-type unit steel trestle	27-inch depth WF beam stringers	36-inch depth WF beam stringers	48-inch depth plate girder			
1															
2	Unit-----	Spans: 17, 21, 27, 31, and 35 feet.	70'-ft 2-girder deck and through spans ¹ .		123-foot span ² ----		None. Ordered by parts as required.	None. Ordered by parts as required.	None. Ordered by parts as required.	40 feet-----	57 feet 10 inches----	100 feet.			
3	Use-----	Spans: 17 to 35 feet----	Spans: 50 to 85 feet.		Spans: 90 to 150 feet.		Piers for I-beam and unit construction bridges.	Piers for through truss bridge.	Marine piers, quay repairs, and railway viaducts.	Span: 19 to 39 feet--	Spans: 30 to 57 feet--	Spans: 56 to 100 feet.			
4	Capacity ²	E-45 loading-----	E-45 loading-----		E-45 loading-----		E-45 loading-----	E-45 loading--	45 tons E-35 loading.	E-45 loading-----	E-45 loading-----	E-45 loading.			
5	Issue-----	Class IV restricted issue	Class IV restricted issue.		Class IV restricted issue.		Restricted issue.	Restricted issue.	Restricted issue-----	Class IV-----	Class IV-----	Class IV.			
			70-foot deck span	70-foot through span	120-foot span	150-foot span									
6	Man-hours ³	400-600-----	1,300	1,500	48,000	410,000	No data ⁵ -----	No data ⁵ -----	12 per ton using power crane. ⁶ 17 per ton using hand crane. ⁶	No data-----	No data-----	No data.			
		Span (feet)													
		17	21	27	31	35									
7	Shipping weight (short tons).	3.1	5.0	6.9	10.0	13.2	35.6	49.8	140	173	Varies with type of pier. See TM 5-374.	Steel: $W_S = 0.2 \text{ HN}^7$ ⁸ Decking and fendering: $W_L = 1.5 \text{ M}^8$	26.0	42.4	136.0
8	Cubage (ship tons).	3.2	3.6	4.8	7.9	8.9	22.5	32.5	140	171	$C_S = 0.7 W_S^7$ ⁸ $C_S = 0.5 W_S^7$ ⁸	Steel: $C_S = 0.7 W_S^7$ ⁸ Decking and fendering: $C_L = 1.6 \text{ M}^8$	20	35	105

¹ Maximum speed is 40 MPH. This must be reduced on 130- to 150-foot through truss spans. See TM 5-372.

² Sets also are provided for conversion to other spans and types of construction. Erection equipment is ordered separately. See TB ENG 56.

³ Tentative. Value is from arrival of equipment on the site and includes unloading and construction in daylight and laying of track. For night, increase 50 percent. Time for erection of piers, approaches, and approach spans is not included. No data are available on V-trestle railway viaducts.

⁴ The 8,000 and 10,000 man-hours, in column 4, cover superstructure only, including placing ties. Estimate 37 man-hours per short ton for erection of this type structure.

⁵ Estimate 30 man-hours per short ton as an overall average.

⁶ Value is based on favorable conditions and experienced crew; and does not include preparation of foundations.

⁷ Formulas for typical L-, V-, and T-shaped piers are approximate only.

⁸ W_S = Weight of steel in short tons.

W_L = Weight of lumber in short tons.

C_S = Cubage of steel in measurement tons.

C_L = Cubage of lumber in measurement tons.

H = Height of trestle in feet.

N = Number of bays per trestle.

M = Thousands of board feet.

* Data are based on information available 1 August 1947.

f. Division Deliberate River-Crossing Equipment Requirements¹

	1	2	3	4	5	6	7
	Type of equipment ²	Narrow river (60-500 feet wide)			Width river (Over 500 feet width)		
		Quantity	Short tons	Measurement tons	Quantity	Short tons	Measurement tons
2	Boat, recon, pneumatic, 2-man	18	0.2	0.9	18	0.2	0.9
3	Boat, recon, pneumatic, 5-man	4	0.2	1.0	4	0.2	1.0
4	Boat, assault, plastic, w/paddles	180	27	763	180	27	763
5	Boat, utility, 27-foot	4	32	180	6	48	270
6	Boat, utility, 19-foot	6	30	150	6	30	150
7	Bridge, floating, foot, aluminum	2	9	14			
8	Ferry, set No. 1, inf spt	5	7.5	4	8	12	6
9	Raft set, inf spt (5 ponton rafts) ³	14	46	364	20	66	520
10	Motor, outboard, 10 HP	4	0.8	2	8	1.6	4.0
11	Motor, outboard, 25 HP	16	5	16	204	65	204
12	Raft, tank (furnished from bridge, floating, aluminum, highway type, deck balk superstructure, on pneumatic floats), capacity, class 60.	4	185	410	6	288	615
			343	1,905		538	5,342

¹ Requirements are based on the assumption of assaulting a river line with four infantry battle groups abreast. To provide a tactical reserve for replacement of combat losses, increase all above requirements by 35 percent.

² For class 60 floating bridge requirements, see paragraph 4.29c. Normally, one floating bridge will be allocated per assault division.

³ In a narrow river crossing, infantry support rafts can be used to construct a class 8 floating bridge in a stream velocity of 3 FPS or less.

g. Characteristics of Mobile Assault Bridging.

	1	2	3	4	5	6	7	8
	Type of bridge	Transportation required	Clear span (ft)	Roadway width (ft)	Capacity in tons	Short tons	Measurement tons	Launching time (min)
2	Bridge, fixed, mobile assault, tank launched, wheeled, mechanically unfolding ¹ .	1 5-ton bridge truck for towing.	40	13½	60	13	43	2
3	Bridge, armored vehicle launched, with transporting launcher ² .	2 5-ton bridge trucks or full-tracked launching vehicle.	60	12½	60	15	45	2

¹ Towed by a 5-ton bridge truck and launched by a medium tank.

² Assault bridge is transported and launched by a full-tracked vehical.

4.30. Field Fortifications

a. *Priority of Work.* The order in which the various defensive measures are to be executed is expressed in order in the form of priorities. The assignment of priorities does not prevent simultaneous work on several tasks. After the location of combat emplacements has been fixed, the normal priority is—

- (1) Clearing fields of fire and removal of objects masking observation.
- (2) Laying of antitank minefields and ex-

cution of important demolitions such as bridges.

- (3) Providing for adequate signal communication and observation systems.
- (4) Preparing individual shelter and emplacement of weapons.
- (5) Preparing obstacles (other than minefields) and other demolitions.
- (6) Preparing routes for movement of reserves and for supply and evacuation.

b. *Works.* (figures are for daylight; for work at night, increase labor by 50 percent).

(1) Time and labor for constructing entrenchments.¹

	1	2	3	4
1	Type of emplacement	Excavation (cu ft)	Number of men working	Approximate time(hr) ²
2	Shallow connecting trench (10-yard section).	150	6	1
3	Standard trench (10-yard section with one firing position).	515	6	6½
4	Special trench for artillery or rear-area installations (2-yard section).	48	1	2½
5	Prone shelter-----	24	1	1
6	1-man foxhole-----	35	1	1½
7	2-man foxhole-----	60	2	2½
8	3-man V-shaped foxhole-----	189	3	5
9	3-man Y-shaped foxhole-----	237	3	6

¹ When ditching machines are employed for excavating, use the following data:

- a. Width of cut 18 to 24 inches.
 - b. Maximum depth of cut 99 inches.
 - c. Excavation rate from 1 to 8 linear feet per minute, depending on the type of soil and excavation.
- For general planning, use 0.7 cubic yards of earth removal per minute in soil of medium hardness.

² Time pertains to average, unfrozen soil.

(2) Revetment estimates.

	1		2	3
1	Type		Quantity of material necessary	Time for construction (man-hours)
2	Sandbag -----	Single row of stretchers for small revetments. Alternate headers and stretchers. Fills, parapets, and breastworks.	160 sandbags per 100 sq ft of surface reveted. 320 sandbags per 100 sq ft of surface reveted. 195 sandbags per 100 cu ft of fill -----	16 per 100 sq ft (includes time for filling bags). ¹ 32 per 100 sq ft (includes time for filling bags). ¹ 20 per 100 cu ft (includes time for filling bags). ¹
3	Issue material -----	Burlap, wire mesh, wire, and pickets.	Burlap—100% of area to be reveted ----- Pickets: Soft soil—1 every 1½ ft. Hard soil—1 every 6 ft. Wire—20 ft for every picket. Wire mesh—100% of area to be reveted.	2 per sq ft.
4	Natural material ---	Brush, wire, and pickets.	Brush—Dependent upon nature of foliage or brush. Pickets: Soft soil—1 every 1½ ft. Hard soil—1 every 6 ft. Wire—20 ft for every picket.	8 per 100 sq ft.

¹ Does not include carry of more than 50 feet.

(3) Clearing. Four man-hours of labor are required for clearing 100 square yards of brush and a few trees up to 12

inches in diameter; for brush only, 2 man-hours.

(4) *Excavation and camouflage data for emplacements.*

	1	2	3	4	5
	Weapon	Type of emplacement	Area to be camouflaged (ft)	Excavation (cu ft)	Man-hours required to construct in medium soil ¹
1					
2	Rifle, US, cal .30-----	Foxhole	10×10	37	1½
3	Rifle, automatic, cal .30-----	Foxhole	10×10	37	1½
4	Launcher, rocket, 3.5-in-----	Pit foxhole	10×10	² 25	1
		Pit	5×5	³ 87	4½
5	Gun, machine, cal .30, lt-----	Horseshoe	15×15	50	3
		Horseshoe	15×15	123	7
6	Gun, machine, cal .30, hv-----	2 foxhole	12×12	74	3
		Horseshoe	15×18	140	8
7	Mortar, 60-mm, on mount-----	3 foxhole	15×15	111	5
8	Mortar, 81-mm, on mount-----	Pit	14×14	70	4
9	Rifle, 57-mm, on mount-----	Pit	16×16	108	6
10	Rifle, 75-mm, on mount-----	Horseshoe	12×15	125	6¾
11	Rifle, 105-mm, on mount-----	Horseshoe	16×16	150	7½
12	Rifle, 106-mm, on mount-----	Horseshoe	24×18	260	12½
		Horseshoe	24×18	260	12½

¹ Time pertains to average, unfrozen soil.

² Without foxholes.

³ With foxholes.

(5) *Barbed-wire obstacles.*

(a) *Estimating requirements.* The minimum length of tactical wire entanglements for a defensive position is 1¼ times the frontage; minimum

protective wire is 5 times the frontage. The length of tactical wire entanglements for a deliberate defense is 5 times the frontage; protective wire is 6 times the frontage.

(b) *Wire entanglement materials for 300 yards of entanglements.*

	1	2	3	4	5	6	7	8	9	10	11
	Type of entanglement	Pickets				Barbed wire, 400-yd, 115-lb reels ¹	Concertinas	Staples made of ½" round drift-pins	Man hours to erect 300 yd of entanglement ²	Short tons	Meas tons
		Extra long	Long	Medium	Short						
2	Double-apron, 4- and 2-pace-----		91		182	12-13			54	1.5	1.4
3	Double-apron, 6- and 3-pace-----		61		122	11-12			45	1.05	.98
4	High-wire (less guy wires)-----		181			15-18			72	1.8	1.7
5	Low-wire, 4- and 2-pace-----			91	182	9			45	1.1	1.0
6	Four-strand fence-----		91		2	3½-4			18	.6	.6
7	Double-belt expedient concertina-----		92		4	2	³ 90	270	36	2.1	2.0
8	Triple-belt expedient concertina, pyramided.	46	92		6	3	³ 135	270	90	3.15	2.9
9	Triple-belt standard Dannert concertina.		146		4	2	54		27	2.25	2.1

¹ Lower number of reels applies when screw pickets are used; higher number when U-shaped pickets are used. Add difference between these 2 to the larger number when wood pickets are used.

² With exception of triple-belt concertina, man-hours are based on use of screw pickets. When driven pickets are used, add 20 percent to man-hours. With experienced troops, reduce man-hours by one-third. Increase man-hours by 50 percent for night work.

³ Based on concertinas being made up in rear areas and ready for issue. One expedient concertina opens to 20-foot length (as compared with 50 feet for a commercially made Dannert concertina) and requires 100 yards of stranded barbed wire; also small quantities of No. 10 and No. 16 smooth wire for ties.

(c) *Wire materials for making expedient concertinas for 300 yards of entanglement.*

Type of concertina	Standard barbed wire, 400-yd reels	No. 10 wire, 100-lb coils	No. 16 wire, 10-lb coils
Double-belt.....	23	1	1
Triple-belt.....	34	1	1

4.31. Minefields

a. For detailed information pertaining to mine warfare, see FM 20-32.

b. Standard Mines.

Standard Table of Mines

1	2	3	4	5	6	7	8
	Description	Net wt (lb) (ea)	Shipping container			Remarks	Storage requirements
			Units per container	Type	Gross wt (lb)	Cubage (cu ft)	
2	Mine, antitank HE, light, M7A2----	4.5	8	metal box	56.0	0.99	Packed complete (w/8 fuzes, mine, AT, M603) (standard).
3	Mine, antitank, HE, heavy, M6A2--	20.0	1	metal crate	29.2	0.46	Packed complete (w/1 fuze, mine, AT, M603) (w/o activator) (standard).
4	Mine, antitank, HE, heavy, M15----	31.46	1	wooden box	49.0	1.17	Packed complete (w/1 fuze, mine, AT, M603, and 1 activator) (standard).
5	Mine, antipersonnel, M2A4-----	5.30	10	wooden box	76.6	1.24	Packed 1 complete mine (w/1 fuze, mine, M6A1, and 1 spool of four 26-ft length of steel wire/CTN, 10 CTN) (10 complete mines w/accessories) (standard).
6	Mine, antipersonnel, M3-----	10.3	6	wooden box	73.2	0.83	Packed 6 complete mines (w/6 fuzes, mine comb M7A1, and 6 spools of steel wire) (standard).
7	Mine, antipersonnel, NM, M14-----	.20	90	wooden box	44.1	1.70	Packed 1/CTN (90 mine fuzes integral and 90 detonators, M46, in set up box and 9 wrenches, M22).
8	Mine, antipersonnel, M16-----	8.25	4	wooden box	44.8	0.77	Packed 4 mines (w/4 fuzes, mine comb M-605, sealed mtl center, w/4 spools trip wire, and 1 wrench, M25).
9	Mine, antitank, nonmetallic, heavy, M19.	-----	1	wooden box	49.0	0.77	Packed 1 complete mine (w/1 fuze, mine, M606, and 1 activator).
10	Flare, mine, trip, M49-----	-----	1	wooden box	42.2	1.03	Packed (16 flares/package, between separators/wooden box).

(Under tactical conditions, all mines, fuzes and detonators will be generally stored in the open.)

For detailed data on specific storage requirements, refer to TM 9-1940.

c. *Minefield Estimates.* The following table may be used for initial estimates of require-

ments for mines and labor required to emplace various types of minefields (par. 4.19e).

MINEFIELD Materiel and Manpower Requirements

	1	2	3	4	5
		Average requirements per 100 yd of minefield trace			
1	Materiel	Antipersonnel minefield ¹	Antitank minefield ¹		
			Protective	Defensive	Barrier
	<i>Antitank mines</i>				
2	Heavy metallic.....		100	² 100	³ 180
3	Heavy nonmetallic.....				³ 120
4	Total antitank mines.....		100	100	300
	<i>Antipersonnel mines</i>				
5	Bounding fragmentation.....	⁴ 400	⁴ 200	⁴ 400	⁴ 400
6	Nonbounding blast (nonmetallic).....	800		800	800
7	Total antipersonnel mines.....	1,200	200	1,200	1,200
	<i>Firing devices for mine activation</i>				
8	Assorted.....			10	120
	<i>Trip flares</i>				
9	Parachute.....	15		15	15
10	Candle.....	5	20	5	5
11	Total flares.....	20	20	20	20
	<i>Barbed wire (marking fence only)</i>				
12	400-yd reels.....	2.25	2.25	2.25	2.2
	<i>Pickets (marking fence only)</i>				
13	Long.....	93	93	93	93
14	Anchor.....	12	12	12	12
	<i>Manpower</i>				
15	Man-hours.....	80	55	96	139
16	Platoon hours.....	2.3	1.6	2.8	4
	<i>Tonnages</i>				
17	Short tons.....	2.7	3.7	5.2	9.2
18	Measurement tons.....	3	4.1	5.1	10.2

¹ Minimum desirable minefield densities per yard of minefield trace are as follows:

	AT	AP (fragmentation)	AP (blast)
a. Protective.....	1	2	0
b. Defensive.....	1	4	8
c. Barrier.....	3	4	8
d. Antipersonnel.....	0	4	8

² Five percent activated with 2 firing devices for each mine.

³ Twenty percent activated with 2 firing devices for each mine.

⁴ Fifteen percent trip wired.

Notes.

a. The above data on materiel and manpower requirements are based on a standard pattern, with 3 strips for antipersonnel, protective, and defensive minefields and a standard pattern with 9 strips for a barrier minefield.

b. Mine and manpower requirements for an irregular outer edge (IOE) strip are not included in the above table. IOE strip-mine requirements for all antitank minefields are determined by computing 1/9 of the mine requirements for a 3 strip standard pattern.

c. No safety factor for loss or damage to mines and fuzes in transport is included in the data above. Normally, 10 percent of the total computed mine and fuze requirements should be added to insure an adequate supply of operable mines.

d. For detailed data pertaining to minefields, see FM 20-32.

d. *Minefield Clearance.* The following table may be used for initial estimates of time and

materiel requirements for clearing or breaching minefields.

MINEFIELD BREACHING/CLEARANCE

Average Time and Materiel Requirements

Method	Width of cleared lane (in yards)	Man-hours required per 100 yards	Remarks
MANUAL			
Location by probing.....	1 (footpath)	15-20	See note.
Removal by rope or explosives.....	4 (vehicle lane)	35-40	See note.
Location by detector, assisted by probing.	4 (vehicle lane)	25-30	See note.
Removal by rope or explosives.....	25	200-225	See note.
EXPLOSIVE			
Demolition snakes, M3A1.....	3-4	0.75	Employment time only. 90-100 hrs required for assembly of M3A1.
Cable, antipersonnel, M1.....	1 (footpath)	3-4	Cable, antipersonnel, M1, is not effective against antitank mines.
Bangalore torpedo.....	1 (footpath)	3-4	See note.

Note. Based upon average conditions of visibility and moderate enemy activity and normal U.S. countermeasures; i.e., screening of enemy observation and counter-battery fires against hostile artillery or other weapons covering the field.

4.32. Demolition

a. Explosive requirements for various demolition tasks vary widely, depending upon the size of the structure, type of construction, type of materials in the structure, age, location, necessary safety precautions, and other factors.

b. The following table may be used for initial estimates of explosive requirements for the more common types of demolition tasks required in creating obstacles.

Materiel and Manpower Requirements for Individual Targets and Obstacles

	Bridges		Tunnels	Abatis	Road craters
	High-way	Rail-road			
Explosive (pounds).....	1,500	3,000	18,000	300	-----
Cratering charges (40-pound can).	-----	-----	-----	-----	17
Manpower (squad hours).	3	4	4	3	2

c. Authorized Division Units under TOE—

Unit	Pounds
Infantry division.....	18,750
Infantry division engineer battalion.....	9,000
Armored division.....	16,600
Armored division engineer battalion.....	12,600
Airborne division.....	11,300
Airborne division engineer battalion.....	4,800
Airborne cavalry troop.....	500
Airborne battle group.....	6,000
Engineer battalion, army.....	5,400

4.33. Fordable Depth of Water¹

Type unit	Depth (ft)
Infantry on foot.....	3½
Horse cavalry.....	4½
Trucks and truck-drawn artillery.....	2 2
Light tanks.....	2 1-3
Medium tanks.....	2 2-4
Heavy tanks.....	2 4-6

¹ Moderate current, hard bottom.

² May be materially increased by suitable waterproofing. For streams of high current velocity, the attitude of the tank to the current has an appreciable effect on the depth which may be forded. The length of time the tank is exposed to the current also has an appreciable effect. Forty-eight inches is the design fording depth of modern US tanks. Experience indicates that tanks can ford slightly greater depths for short distances without going out of action.

4.34. Load Bearing Capacity of Ice

The strength of ice varies with the structure of the ice; the purity of the water from which it formed; the cycle of formation, or freezing, thawing, and refreezing; temperature; snow cover; and water currents. The sustaining capacity of ice is not definitely determined, but experience and tests provide working-capacity figures for good quality ice of varying thicknesses as given in the table below.

Load	Minimum thickness of ice (in.)	Minimum interval between tracks, or distance between elements (ft)
Single rifleman on skis or snowshoes--	1½	16
Infantry columns, single horses, motorcycles, unloaded sleds.	4	33
Single light-artillery piece; ¼-ton truck, 4 x 4.	6	49
Light artillery, passenger cars, light total load of 3 tons.	8	65
2½-ton trucks, light loads-----	10	82
Closed columns of all arms except armored force and heavy artillery.	12	98
Armored scout cars, light tanks-----	14	115
20-ton vehicles-----	16	131